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Growing Electrical Exports

The figures of the Department of Commerce and Labor for the export trade of October continue to show the upward trend of electrical development in this branch of our foreign business. The total exports of electrical goods in that month reached an amount not less than $2,078,501, as compared with $1,434,650 in the preceding year for the same month. This is a gain of about 40 per cent. The interesting fact is that it lies concealed in that tantalizing bunch of "all other," which jumped from $786,718 to $1,295,368. The total figures for the ten months ending October are also interesting, as they run as follows: 1910, $14,031,971; 1911, $15,596,757, and 1912, $18,755,996. It will be seen at once that gains in foreign trade are cumulative and almost compounding, and equal the rapid advances that are going on in the industry considered purely from the domestic standpoint. All of this gives a new and acute interest to the tariff changes that may occur under our new political régime with the incoming of a new Congress and a new President pledged to "tariff reform." Personally and collectively we are heartily in favor of anything and everything that will reduce the "high cost of living" and will assist at the same time in the development of our foreign trade through export and interchange, but we are nowise envious of those whose intimate duty and responsibility it is during the next few years to adjust and solve all these intricate problems. One of our New Year pledges might well be to help them.

Lucid Rate Schedules

How thoroughly awake the well-managed public-utility companies are to the importance of their relations with the public is made evident by the fact that so many of them have a responsible officer in direct charge of such relations. These officers are responsible for the courteous treatment of their patrons at all times and under all conditions. The obvious phases of such work are the adjustment of disputed bills, alleged meter errors, failure to make prompt installation or removal of service connections, correcting the causes of poor service, and the like. There might be included in this list the matter of handling new or prospective customers with proper consideration and tact, making clear what the service will cost and how the bills will be rendered. Above all, there should never be placed in the hands of the non-technical consumer without careful personal explanation a schedule of rates or data in relation thereto which is not on its face reasonably self-evident. An example of unintelligible data placed in the hands of a new consumer without any explanation whatever was given under the title "Rate Schedules from the Customer's Standpoint" on page 49 of last week's issue. Matters of this kind should not be handled by correspondence, but instead by personal visit on the part of a solicitor. Clearly enough the work of the solicitor is lessened if the rate schedules are simple and easily grasped by the lay mind, in contrast with some of the complicated schedules which are not as rare as they might be, or those defective schedules which require the solicitor to avoid pitfalls which may invite the customer's criticism or arouse his distrust. The thing first desired is the simplest form of schedule which is equitable, and the second thing is a clean-cut explanation of it in simple language.

The Reader's Viewpoint

Few are the electrical problems on which there is not room for difference of opinion. Exhausted subjects are equally rare. When readers disagree with opinions or statements of fact in the *Electrical World*, or when they can amplify such statements—add their own experience to that of others—they are invited to write a "letter to the editors." Communications of this kind are welcomed, because the *Electrical World* aims to be a mouthpiece, a medium of expression, for every man who has something worth while to say on electrical topics. And there is no other forum where what is said reaches a larger or more interested audience. This is another reason why this invitation to correspondents should be accepted—freely and often.

Oil-Engine Characteristics

The report by Messrs. Potter and Carlson of tests on an internal-combustion engine using heavy oil, on page 105 of this issue, is a very timely contribution to the literature of prime movers. At the present time the increase naturally to be expected in the price of gasoline in response to the enormously increased demand of the last few years is already taking place. In the ordinary course of refining petroleum only a small percentage of the products of fractional distillation come within the limits of density which generally used to be assigned to gasoline and kindred products; therefore, the demand created by automobiles has been very strongly felt. Although the production of the lighter hydro-carbons has been increased by "cracking" the heavier product, it is still true that the demand for gasoline is relatively increasing while that for the oils of the kerosene class is relatively diminishing. It is, therefore, extremely desirable to utilize if possible for electrical generating purposes the heavier oils, as has been done with a considerable degree of success in the Diesel and similar engines. From a thermodynamic standpoint these have given excellent results, working at very high pressure and

high compression. Yet from these very characteristics they are high in first cost and have not appealed to the ordinary user of moderate amounts of electricity.

The particularly interesting feature of the test described is that the engine used was a very simple four-stroke-cycle, single-cylinder machine and operating at moderate pressure on fuel oil of the density of very heavy kerosene. The engine was of 75-hp rating with a 16-in. by 24-in. cylinder and ordinary make-and-break ignition worked with an auxiliary water spray and operated at a barometric pressure about 3 in. below normal, corresponding to an elevation of 2850 ft. This last condition, owing to decreased density of the charge, implied lower output on a given working condition, so that the mechanical efficiency must have been slightly reduced. The test was made with a Prony brake under carefully regulated conditions and the results proved to be highly interesting. The engine was started either by compressed air or by priming with gasoline, and when in operation the fuel oil was vaporized in a special coil outside the engine heated by the exhaust. At approximately full load and a mean effective pressure of 75.9 lb. per square inch, the engine under a three-hour test operated on 1.01 lb. of oil per brake-hp-hour. Bearing in mind the fact that at normal barometric pressure the output would have been increased by somewhat more than 10 per cent without an equivalent change in the mechanical efficiency, it is clear that this machine would actually produce a brake-hp-hour on somewhat less than 1 lb. of fuel, the corresponding half-load consumption per brake-hp-hour being about 1.25 lb. The thermal efficiency was 14.62 per cent at full load and 11.7 per cent at half load.

As to general operation, the experimenters report excellent performance, although the record taken of the explosion pressures indicates that the governor was not working as steadily as might have been the case. The thermal value of the fuel oil is approximately 17,000 heat units per pound, which is not at all exceptionally high. This sort of performance for a very simple engine of the low-pressure class is highly satisfactory, showing that for stationary use even in units of very moderate size the heavier fuel oils can be employed economically. In the present state of the gasoline market this is an important matter, particularly since an expensive type of engine need not be installed for the utilization of the heavier oils as fuel.

From the standpoint of the electrical engineer the tests are instructive as showing, first, that under ordinary conditions of loading the cost of operation of even so effective a unit as this rises to a point where electric energy can easily remain a competitor, and, second, that prime movers of this kind operated at full load, as they would be in an auxiliary electric plant for emergency service, can be worked economically. The weak point of all explosion engines is their loss of economy when operated at the low and variable loads which are most common in general industrial service. Such loads can well be carried by the electric motor. Electric distribution, therefore, has little to fear from the improvements in internal-combustion engines and is likely to gain more than it loses by itself being able to utilize the improved prime movers under conditions of maximum efficiency.

A Notable Swedish Enterprise

One of the largest transmission plants thus far installed has recently been placed in service at Trollhättan, in Sweden. It is a government enterprise utilizing as its storage basin Lake Vänern, the third largest lake in Europe, with an area of 2150 sq. miles. The outlet of this great body of water, the Göta River, is normally, as might be expected, a comparatively steady stream, the minimum flow being about one-third the maximum. With the regulation possible to be applied on the lake the minimum flow can be considerably increased and the possible output will rise to not less than 200,000 hp. Approximately half this amount is the output planned for the present installation. The hydraulic situation seems to be a very favorable one, for the canal required for its development is only seven-eighths of a mile long from intake to forebay. The equipment of the initial plant consists of eight 10,000-hp turbines, six of which are already in operation and the others under construction. These turbines are double-runner units of the Francis type, working under 108-ft. head, each directly coupled to a 11,000-kva generator. With the gates wide open the turbines will deliver 25 per cent over their normal rating. It is interesting to note that the efficiency of these turbine units rises at full load to 87 per cent, while that of the generators rated on 80 per cent power-factor reaches 90 per cent.

The general station design is not out of the ordinary, but some details of equipment are of special interest. The stators are inclosed and the rotors are equipped with fans which draw air from the outside and force it through the stators and thence into outlet flues. These flues are arranged to discharge heated air into the racks throughout the winter, to decrease the danger of clogging from ice. Three exciters, directly driven from waterwheels operating in conjunction with a battery of 1000 kw-hr. storage capacity, take care of the energy needed for excitation. In connection with the exciting system use is made of a booster coupled to the shaft of each machine unit, which abolishes the need for main-field regulators, the whole regulation being accomplished by varying the booster-field magnetism.

The large generators deliver energy at 25 cycles, a frequency most unusual in European installations. Its chief reason for being is found in the fact that the Trollhättan plant will very probably be used to supply energy for railroad electrification. The probability of electrification of the Swedish government railroads, which has been greatly favored, was borne in mind in designing the generators, which have a single-phase rating of 6500 kw at 85 per cent power-factor and can conveniently be used for the railway work. Energy is taken from the generators through lead-covered cables passing to the switch house by way of a tunnel and fed to duplicate low-tension busbars. The dangers that lie between the generator terminals and the switchboard were not altogether forgotten, each generator being equipped with an automatic oil circuit-breaker in the generator house itself, a precaution far too often neglected in modern plants with isolated switch galleries.

The present transmission emf is very moderate, only 50,000 volts, inasmuch as the main transmission lines to the city of Gothenburg and to Skara are only a little more

than 40 miles in length. Both of these lines are arranged with duplicate circuits. The supports are of flexible steel frames designed to yield and relieve the strain instead of breaking in an attempt to support it. Two strain towers per mile are used to limit the action of distributed strains, the normal spacing of the flexible towers being about 600 ft. The strain towers anchor the wire on pin-type insulators, while the flexible towers are equipped with suspension insulators. A grounded steel cable serves to decrease the danger from lightning. Altogether the Trollhättan plan is a very notable enterprise both in size and in its probable economic effect on manufacturing and railway operation.

Artificial Telegraph and Telephone Lines

There are two well-recognized types of artificial line on which the transmission of electric waves or impulses can be studied in the laboratory. One of these is built of successive lumps of series impedance and shunt admittance. The other is built with distributed series impedance and shunt admittance. The first type may therefore be described as "lumpy" and the second as "smooth." Lumpy lines have the advantage of being simple, compact and relatively inexpensive. Smooth lines have the advantage of more nearly representing the electrical conditions along actual conducting circuits, overhead, under ground or under water.

The first artificial lines described in electrotechnical literature seem to have been constructed by Cromwell Varley, of Varley-Loop fame, in 1862, for duplex telegraph purposes, and were of the lumpy type, containing only series resistance and shunt capacity admittance. Smooth lines of the same electric character were introduced by Muirhead in 1875. Pupin introduced the additional element of series magnetic reactance into artificial lines, both of the smooth and lumpy types, about 1890. In smooth artificial lines containing series magnetic reactance the coils containing the latter must be wound so as to form layer by layer one of the plates of a condenser. This calls for the careful insulation of every meter of the wire entering into the coils. In recent years artificial energy transmission lines, both smooth and lumpy, have been described in our columns in some detail. The smooth lines are particularly well adapted for oscillographing impulses and transient electric phenomena. The lumpy lines exercise certain selective influences on the propagation of impulses, so that high-frequency and steep-fronted waves are subject to deformation in transmission. How much deformation occurs depends upon the number and the size of the lumps forming the line. In the steady alternating-current state, however, it is an easy matter to correct for the effects of lumpiness to any desired degree of precision. That is, the behavior of any given lumpy line under steady alternating currents is easy to determine, although the behavior under sudden impulses of any assigned wave-form may be difficult to ascertain.

In the *Elektrotechnische Zeitschrift* Herr Karl Willy Wagner has recently described an interesting new form of lumpy artificial line, constructed like a single-section telephone switchboard and containing fifty line sections in all. The novel feature of this line is that each line section has its capacitance and resistance adjustable in four steps, so that the series impedance, as well as the shunt admittance, of each line section can be altered in a variety of steps, with the aid of small fixed switches grouped conveniently for that purpose on the face of the switchboard. Not only can the line length be adjusted at will by altering the number of line sections in series, but the electrical constants of each line section can also be adjusted within a certain range by setting all the switches conformably. In this way the line can be made to resemble either a submarine cable, an energy-transmission cable or an overhead line, etc., at will. The only apparent disadvantage accruing in this form of variable-constant artificial line is the large number of switch contacts which are introduced semi-permanently into the circuit, some of which may become imperfect after a time.

Nearly all of the experimental work on the new artificial line, as reported in the articles referred to, has been devoted to the oscillographic study of transient impulses. In this direction the line has only a limited degree of precision, owing to its lumpiness as well as to its range of variation in constants, due to imperfect penetration or to variable hysteresis at high frequencies. However, by keeping the fundamental rate of oscillation below the natural rate of oscillation of each line element taken separately, the discrepancies due to these disturbing influences have been kept within relatively small limits, and the oscillographic records obtained are of great importance as showing very clearly the ordinary switching-in and switching-out phenomena at the ends of an energy-transmission line.

Of still greater interest are the reflected disturbances at the junctions of sections differing in surge impedance, as well as the effects on transmission or reflection caused by loads inserted in the line. It is here that the lumpiness of the line tends most to distort the oscillographic records. Nevertheless, the general results are of great practical qualitative significance and support the existing theory of the subject.

The number of experiments that can be made with such an artificial line is so great and they give so much practical information that we believe every important electrotechnical laboratory will have to be equipped sooner or later with such apparatus. Whether it should be of this multiple-constant type is open to discussion. Where qualitative or first-approximation quantitative results only are sought, then it would seem that this multiple-constant type, with switching devices, might be most advantageous both in floor area and first cost. Where, however, careful quantitative research is sought for the greatest practicable precision of measurements, it is probable that single-constant lines are preferable, which can be varied only in length, one line being constructed for each type. This means one artificial energy-transmission line, one artificial submarine cable, one artificial telephone line, etc.; but it eliminates all the semi-permanent switching contacts and enables careful measurements to be made of each line at the frequencies which naturally pertain to it. However, these are questions that relate only to constructive detail. The main consideration is for every electrical engineering student to use and become familiar with the behavior of properly constructed artificial lines in the laboratory before he undertakes to learn the operation of such lines in industrial practice.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Electrification Plans of Chicago, Milwaukee & Puget Sound Railroad

As announced elsewhere in this issue, the Great Falls Power Company, of Montana, has secured from the federal authorities for a term of fifty years the grant of a right-of-way across the public domain for a 150-mile transmission line. This grant is conditional upon the sale of a large amount of energy to the Chicago, Milwaukee & Puget Sound Railroad for the electrification of 450 miles of its main line, from Harlowton, Mont., to Avery, Idaho. The announcement of the grant to the power company, just made public by the Department of the Interior, has been confirmed by President A. J. Earling of the railroad company, who expects the electrification project to be in operation within three years.

Although the details have not been arranged, yet the electrification plans provide for handling all traffic by electric locomotives, of which from fifty to a hundred will be required. The plans for the equipment and overhead construction are being completed rapidly, the intention being to begin the work of installation within eighteen months.

A contract has been signed with the Montana Power Company, which controls the Montana Power Transmission Company, the Madison River Power Company and the Thompson Falls Power Company. Energy at 110,000 volts and at 60,000 volts will be fed to the railroad company at eight different points on its right-of-way, the minimum requirement for power being 25,000 kw and the maximum for the present 50,000 kw. References to the plans now announced were made on pages 1116 and 1117 of our issue dated Nov. 23, 1912, and the plans of the Montana Power Company were outlined on page 1339 of our issue of Dec. 21, 1912. Five stations of the Montana Power Transmission Company, three stations of the Great Falls Power Company and the station of the Thompson Falls Power Company will supply the load. The Thompson Falls Power Company is now constructing a 50,000-hp hydroelectric station at Thompson Falls, Mont., and the Great Falls Power Company has also under construction a 130,000-hp hydroelectric development on the Great Falls of the Missouri, at Great Falls, Mont. In addition the latter company has in operation at Rainbow Falls a 21,000-kw station and at Black Eagle Falls a 10,000-hp development. The Montana Power Transmission Company has the following stations in operation: Madison River Development No. 1 (3000 hp), Madison River Development No. 2 (12,000 hp), Big Hole Development (5000 hp), Canyon Ferry Station (12,000 hp), and a station at Hauser Lake (25,000 hp).

Rewards by American Museum of Safety

At the annual exercises of the American Museum of Safety, to be held in the Engineering Societies Building, New York City, on Thursday evening, Jan. 23, the Rathenau medal will be awarded to Mr. Thomas A. Edison for the "best device or process in the electrical industry for safeguarding industrial life and health." This medal was placed at the disposal of the Museum of Safety by the Allgemeine Elektricitäts Gesellschaft. The *Scientific American* medal will be awarded to the Draeger Oxygen Apparatus Company for the "most efficient safety device invented during the last three years and shown at the Museum's exhibit hall." The Travelers' Insurance medal will be awarded to the New York Edison Company as being that "American employer who has done the most for the protection of the lives and limbs of workmen." The Louis Livingston Seaman medal will be awarded to the National Cash Register Company for "progress and achievement in the promotion of hygiene and sanitation and the mitigation of occupational disease."

Society for Electrical Development, Inc.

Final approval of the complete plan under which the Society for Electrical Development, Inc., proposes to conduct a broad co-operative movement for the benefit of the entire electrical industry, as has been outlined in these columns, and authorization of the announcements which are to be sent out, containing a complete description of the movement and covering the election of officers, will be the business before the society's organization committee at its next meeting, to be held in New York on Jan. 14.

The society expects to obtain sufficient funds through its financial plans to enable it to maintain a working capital of $200,000. As reported, the various central station, jobbing, contracting and manufacturing interests represented by the members of the organization committee have pledged approximately $125,000 for the work of organization.

In view of this support and the indorsement of the plan by the interests represented by the committee, a list of whose members appeared in the *Electrical World* for Sept. 7, 1912, those associated with the movement feel that the industry at large will regard the plan in a favorable light and that the balance needed to bring the funds up to $200,000 will be readily pledged by those eligible for membership in the society.

High-Tension Transmission on Canal Zone

A committee has been appointed to review the plans for the proposed high-tension transmission line across the Isthmus of Panama, to consider the various features of the telephone and telegraph cables, the possible disturbance to signal systems, the probability of the future electrification of the Panama Railroad, and to make recommendations relative to the best and most economical construction to be employed for all the different electrical conductors, all phases of the matter being taken into consideration, including protection to electrical lines, and safeguard against any possible attempts to cut communication in time of war. The committee consists of Mr. Edward Schildhauer, Lieutenant L. Mears, Captain W. H. Rhodes, Mr. C. F. Bleakley, Mr. W. H. Fenley and Mr. W. R. McCann.

Commercial Cable Company Cuts Rates

The Commercial Cable Company announced on Jan. 1 that its rate of 12½ cents a word for deferred plain language messages had been cut to 9 cents, applicable to the same territory as that covered by the reduction in cable rates recently announced by the Western Union cable lines. A new rate of 9 cents a word for special deferred messages of four words each was also announced.

Output of Large Generating Systems

The accompanying table gives information relative to the outputs, peak loads and load-factors of the central stations in Chicago, New York, Philadelphia, Boston and Brooklyn for the year just closed. The Commonwealth Edison system still has the highest peak load and the largest output of the central-station systems, owing to its great railway load. The New York Edison Company has recently taken over the load of the Third Avenue Railroad Company, approximating 28,000 kw, but too late to make any impression on the yearly output. In this connection the output

DATA ON LARGE GENERATING SYSTEMS

System	Peak Load in Kw	Date of Peak Load	Yearly Output in Kw-hr.	Yearly Load Factor of System, per Cent
Commonwealth Edison..	233,000	Dec. 11	799,000,000	43–44
New York Edison*.....	189,726 210,813	Dec. 20 Dec. 23	513,926,429 †619,290,064	30.8 †33.4
Philadelphia Electric‡...	65,489	Dec. 23	183,969,655	32
Boston Edison.....	60,143	Dec. 18	161,702,955	30.6
Brooklyn Edison.....	42,500	Dec. 17	125,770,000	33.7

*Exclusive of service to railroads.
†Including railroad load estimated for entire year.
‡Philadelphia only.

of the Niagara Falls Power Company and the Canadian Niagara Power Company, which virtually comprise a single system, the stations being operated in parallel, is of interest. The peak load on that system occurred on March 8 and was 115,900 kw. The output for the year, however, was 868,392,750 kw-hr. and the load-factor of the system (ratio of yearly average to highest peak in year) was 82.29 per cent, making it in point of the output the largest system in the world. The figures, however, do not reflect natural conditions at Niagara Falls. During most of the year the output of each of the plants was rigidly limited by the restrictions of the Burton act, and during a large part of the year a part of the Buffalo load was supplied from the plant of the Toronto Power Company at Niagara Falls, Ont.

American Economic Association Discusses Government Regulation of Prices

At the closing session of the Boston meeting of the American Economic Association, Professor J. M. Clark, of Amherst College, read a paper on "Governmental Price Regulation." Professor Clark declared that the country does not yet know as much about price regulation as many optimists suppose; and far from being the simplest way of handling the trusts, this method, he said, if carried through to the end, might unsettle our economic foundations in a way now little suspected. The simplicity of price regulation, in his opinion, is a most deceptive aspect. The Interstate Commerce Commission has not yet solved satisfactorily the problem of regulating the general level of railway charges, which is admittedly a difficult problem. Professor Clark pointed out the difficulty of meeting the fact that prices which will give reasonable earnings to some producers might spell ruin to others less efficient. Another serious difficulty, and perhaps the greatest one, is the necessity of regulating the quality of goods sold, as well as the prices. And it will be impossible to regulate the price of things which the trusts sell without regulating also the price of the things which they buy, wherever they become monopolistic in their buying. He declared that the prevention of discrimination and the revision of the patent system form the backbone of the program of those who would avoid the necessity of price regulation by restoring competition.

French Decision in Wireless Telegraph Patent Case

The validity of the Marconi patent for tuning in wireless telegraphy was recently upheld by a decision of the French court rendering a judgment in favor of the Marconi interests against the Compagnie Générale Radio-Télégraphie and the Société Française Radio-Électrique. An injunction was issued prohibiting further infringement, the infringing apparatus was ordered confiscated, and costs and damages were awarded to the Marconi company. The validity of the British patent for the same invention was upheld by the High Court of Chancery in England about a year ago in a suit brought by the Marconi company against the British Radio Telegraph & Telephone Company.

The American patent for this invention, which is owned by the Marconi Wireless Telegraph Company of America, is the basis of litigation now pending in the United States courts against several other wireless companies.

Water-Power Concession at Long Sault Rapids Declared Void

Attorney-General Carmody of New York sent to the State Senate on Jan. 1 an opinion to the effect that the law passed by the 1907 Legislature and signed by Governor Hughes granting a charter to the Long Sault Development Company is unconstitutional. The charter authorized the company to generate electric power at the Long Sault Rapids, in the St. Lawrence River, and provided for a minimum revenue to the State of $50,000. The grant was attacked under the Dix administration on the ground that the natural waters belong to the State and should not be disposed of to private corporations. Legislation was sought last year which would deprive the company of its rights, with provision for compensation for any outlay; but this failed of passage, and in its place a resolution was adopted asking the Attorney-General for an opinion. The Development Company disposed of its interest in the grant to the so-called "Aluminum Trust" and capitalists of Pittsburgh, but no power has yet been developed on the site. The Attorney-General holds that the law of 1907 is unconstitutional because it contravenes the section providing that the Legislature shall pass no private privilege or franchise, and also that it violates the provision of the constitution requiring that the forest preserve shall be forever kept as wild forest lands and shall not be sold to or taken by any corporation.

Massachusetts Electric Lighting Association

The annual meeting of the Massachusetts Electric Lighting Association was held at the Exchange Club, Boston, Mass., on Jan. 4, with President C. L. Edgar in the chair. About 125 of the leading central-station men in New England were present, and at the conclusion of the usual dinner a comprehensive address upon "Workmen's Compensation" was given by Mr. Herbert Wolfe, of New York. The speaker emphasized America's tardy recognition of the importance of the broad treatment of employees' accidents and illness and described the development of workmen's compensation in Germany since its inception. More than 9,000,000 employees are now protected in this manner. The latest liability laws in American states were reviewed and Mr. Wolfe accorded highest praise to the Massachusetts statutes as model legislation in this field. He contended that the cost of industrial accidents is as much a factor in production as is fire insurance, and that it should be met by the consumer. Careful application of principles is necessary to success. Mr. Magnus W. Alexander, of the General Electric Company, Lynn, Mass., a prominent framer of the Massachusetts statute, also spoke briefly, urging the utmost effort to reduce industrial accidents to a minimum. He

advocated employees' sharing a portion of the accident premium, so that in time the exercise of greater care will result in its being perceptibly reduced.

The following officers were elected: President, Mr. C. L. Edgar, Boston; vice-presidents, Messrs. C. F. Pritchard, Lynn, Mass., and R. W. Day, Springfield, Mass.; executive committee, the foregoing officers and Messrs. F. S. Pratt, A. E. Childs, A. B. Tenney and Philip Cabot, Boston; Mr. R. W. Rollins, Worcester, and Mr. J. W. Stevens, Greenfield, Mass. Mr. Everett W. Burdett, Boston, is secretary and general counsel.

Supreme Court Interpretation of Sherman Law

The United States Supreme Court recently handed down a decision upholding the indictments against the men concerned in the so-called Patten cotton pool, which is generally regarded as having a far-reaching effect upon attempts to corner supplies of food products or commodities of any kind. The court did not pass upon the guilt of the defendants, but merely gave its judgment as to the applicability of the Sherman act assuming the facts in the case to have been correctly stated. Apparently this decision means that not only corners in cotton but any attempts on the part of speculators to advance the price of any commodity by withholding supplies from the market may be held as a violation of the Sherman law. Obviously this applies to wheat, corn, pig-iron, lard, copper or any other commodity that is being held off the market in an organized attempt to elevate the prices above what otherwise would be their ordinary level. It has been accepted as certain that the decision will discourage pooling operations in all the public commodity markets, but there are many who feel that the scope of the decision will be gaged better after the indicted cotton operators have been brought to trial and either convicted or acquitted. It is also believed that the present decision will have considerable bearing on the situation in Congress in reference to the proposed revision of the Sherman law.

Federal Grant to Great Falls Power Company

What Secretary of the Interior Walter L. Fisher has declared to be the beginning of the electrification of all transcontinental railroads between the Rocky Mountains and the Pacific Coast was made by a right-of-way grant for a period of fifty years, given this week by the Interior Department to the Great Falls Power Company, of Montana, for a double-circuit transmission line 150 miles in length, by which the company will furnish energy to the Chicago, Milwaukee & Puget Sound Railway for the electrification of 450 miles of its main tracks between Harlowton, Mont., and Avery, Idaho. What is considered highly important is the fact that this step is to be taken under a grant which embodies the fundamental principles of water-power policy which Secretary Fisher has been advocating for the past two years. It demonstrates, in the opinion of Secretary Fisher, not only that the provisions for the protection of the public interests upon which the department insists do not prohibit water-power development, as has been claimed by its opponents, but that the greatest development which has yet taken place in the practical application of electricity can be and is being taken under these very provisions. The grant just issued provides for compensation to the federal government, very small at first, but subject to periodical readjustment every ten years. It provides for regulation of the rates and service, uniform accounting and complete publicity of books and records, the sale of energy to the United States and to the State within which the transmission lines are located, and to municipal corporations in such State, at as low a rate as that given to any other purchaser for a like use under similar conditions. The company is forbidden to claim any earning value for the grant or any selling value should the public take over the company's works at any time. The compensation or rentals fixed for each decade must be reasonable, and the company has the right to contest in the courts any rental it believes to be unreasonable, but the burden of proof on this point rests on the company.

This transmission line is already in operation, having been built under a revocable permit issued in 1909. At that time no better right could be given for any power development, but the agricultural appropriation act of March 4, 1911, authorizing the making of fifty-year grants for transmission, telegraph and telephone lines, provides that the grants are to be made under general rules and regulations to be fixed by the Secretary of the Interior. The act provides that old lines already constructed can have the benefit of the statute on like "terms and conditions" as new lines, and, in view of the importance of this application to travelers and shippers by rail, and in further view of the fact that only transmission lines, not water-power sites proper, are involved, Secretary Fisher has felt justified in ruling that he has the power to impose specific terms and conditions under this statute. The power company desired the more permanent right obtainable under this new law because it has agreed to sell a large amount of energy to the Chicago, Milwaukee & Puget Sound Railway Company for electrifying 450 miles of railroad. The latter project was mentioned on page 1339 of our issue of Dec. 21, 1912. The installation of the new system will involve the expenditure by the railroad of many million dollars, and the railroad company was unwilling to invest so large a sum while the power company's rights were revocable in the discretion of the government. Therefore Secretary Fisher's grant is conditioned upon the power company's entering into and performing its obligations under a contract to supply electricity for the motive power of the railroad. The demands of the railroad under this contract with the power company must be supplied by a new hydroelectric plant at Great Falls, which will be of twice the capacity of the present plant at Rainbow Falls.

The amount of the rental for the first ten years will be nominal as compared with the magnitude of the power company's operations, and Secretary Fisher's idea is that it should remain at a very low figure so long as the prices exacted of energy consumers are reasonable. It is not his purpose to use rental charges of this character as a source of general revenue in lieu of federal taxation, but if at the end of any ten-year period it should appear that the company was charging consumers unduly high prices and thus increasing its profits beyond the standard of a reasonable and generous return upon its investment, the government could then increase the rental charge. Secretary Fisher considers that the fact that his successor will have the power to do this will, of itself and without the exercise of that power, exert a constant pressure upon the company, inducing it to make its price reasonable even if the state authorities should neglect to enforce effective regulation on their own initiative.

Annual Report of the Commissioner of Patents

The annual report of the Commissioner of Patents for the fiscal year ended June 30, 1912, has recently been transmitted to Congress. The report shows that there were 69,236 applications for patents for inventions and a total of 79,747 applications for patents, trade-marks, labels and prints. On July 1, 1912, there were 21,059 applications awaiting action on the part of the Patent Office. During the year 19,634 patents expired. During the past five years the number of patents granted annually has not varied to a substantial degree. The number of patents granted during 1912 was 34,220, while the total number of patents, trade-marks, labels and prints was 41,067.

The total receipts of the office from all sources during the fiscal year were $2,094,060, and the expenditures were $2,025,912. The net surplus for the year, amounting to $68,047, brought the accumulated surplus up to a total of $7,132,073. The total number of applications of all kinds, including disclaimers and appeals, was 81,459, or 5076 more than for the year preceding. The commissioner pointed out that the increased receipts of the office reflect the marked prosperity of the country. The condition of the Patent Office is reported as fairly good considering the severe handicaps of insufficient force, inadequate salaries and lack of sufficient room and proper equipment with which to carry on the work. During the fiscal year there were 1642 interferences declared, of which 1241 were disposed of before final hearing, 239 were heard and 54 are awaiting decision. The total number of appeals disposed of in interference cases, including *ex parte* appeals, was 837.

The commissioner renewed his recommendation to establish the Patent Office as an independent bureau. Once again he called the attention of Congress to the disgraceful condition of the Patent Office quarters in respect to overcrowding and the serious fire risk. The commissioner's report was submitted in advance of the report of the President's Commission on Economy and Efficiency, which has since completed an investigation of the Patent Office, and therefore contains no discussion of the features covered by this investigation. An abstract of the report of the Economy and Efficiency Commission was presented in our issue of Dec. 14, 1912, page 1250.

Recommendation of Governors on Public Utilities

In the recent political campaign a number of platforms adopted by political parties had to do with the regulation of public-service corporations. It is therefore natural that many of the governors should suggest legislation along this line, especially in those states where public-utility regulations are not yet in force. Brief abstracts of some of the utterances of governors relative to such legislation are given below.

CONNECTICUT

Governor Simeon E. Baldwin in his message to the General Assembly of Connecticut said that the results attained by the Public Utilities Commission have fully justified the expectations of those who contributed to its creation. One of them has been a steady influence for good exercised upon the corporations within its jurisdiction in a quiet and semi-official manner, though seldom coming before the public eye.

PENNSYLVANIA

As is probably well known, Pennsylvania at present possesses no public service commission, and in his message to the General Assembly Governor John K. Tener urged the early passage of a sane, sound, comprehensive and effective public-utilities law, framed along substantially the same lines as that drafted by Attorney-General Bell, which failed of passage at the last session of the General Assembly. He said that there is unquestionably a universal demand for the enactment of such a statute, and while he anticipated that several bills concerning the subject would be introduced, he urged that early reference of such proposed legislation to an active committee be accorded, and that, if necessary, the committee report a new and composite bill which shall contain the best provisions embodied in any or all of the bills suggested and culled from the field of such legislation in other states.

RHODE ISLAND

In his inaugural message Governor Aram J. Pothier of Rhode Island said that recent events (indictment of the presidents of the New Haven and Grank Trunk Railroad systems) demonstrated in an emphatic manner the importance to the public of a state department exercising the functions contemplated when the Public Utilities Commission was created last year. The efficiency of such regulation should be maintained, the Governor said, by vesting sufficient power and authority in the commission to enable it to achieve the results for which it was created. The rates charged for the service rendered by the various utilities are now matters of record with the commission, but with no authority to inspect their securities or to make a physical valuation of their properties the commission finds it difficult to determine whether or not the rates charged are just or such as would be warranted to insure a fair return on the capital invested. In the opinion of Governor Pothier provision for such physical valuation of the property of all public utilities operated in the State and also for the inspection of their securities by the commission should be made by an amendment to the present law. The commission also should have the power of prescribing proper and uniform accounting methods and of requiring from all companies under its jurisdiction reports of operating expenses and financial and other data. It appears that no provision is made in the Rhode Island law for the appointment of experienced men to act as inspectors of the equipment of steam and electric railways and of the gas and electricity supplied for public consumption. Until such systematic inspection is afforded, the Governor said, the quality of service rendered the public will continue to depend largely upon the utility furnishing it. The most important need, however, in his estimation is some provision for the physical valuation of utilities and the inspection of their securities, and he recommended to the General Assembly the enactment of an amendment to the present law containing such provision.

MICHIGAN

Governor W. N. Ferris in his message to the Legislature of Michigan made certain recommendations with respect to a public utilities commission. The State now has a railroad commission which has the power to fix the rates and regulate the practice of railroad, telephone and power companies. The Governor recommended the enlargement of the powers of this commission to cover all public-utility corporations of the State, and inasmuch as there can be no intelligent fixing of charges without a knowledge of the real value of the properties, he also recommended that the commission be authorized to make physical valuations of all such properties as it may deem advisable in order that the rates fixed may net a reasonable return on the actual cash invested.

MASSACHUSETTS

In his address to the two branches of the Legislature Governor Eugene N. Foss confined himself to a discussion of what he considered to be the supreme issue, the struggle between the people and the transportation monopoly for control of the government. He said that the commonwealth should not aspire to control railroads beyond its borders but should exercise fully its real power to regulate. With regard to the railroad situation the Governor said that, as a practical issue, public ownership of railroads may soon be the only policy left and that those who believe that public ownership of public property and public performance of the public service of railroad transportation are socialistic and otherwise undesirable need not look to the present masters of the railroad system to defeat the proposal of government ownership. Most of them desire it and have been piling issue upon issue of bonds and stocks on their properties in order, if occasion comes, to unload upon the government. The only way to postpone national ownership of railroads and to retain in the commonwealth the power to regulate its transportation system, Governor Foss maintained, is to assert that power at once and to apply it with-

out delay. He therefore renewed his recommendation that a powerful public service commission be created armed with mandatory authority over the public service so far as Massachusetts is able to control this.

The Silver Voltameter—Part III

By E. B. Rosa, G. W. Vinal and A. S. McDaniel

The second series of quantitative experiments was begun in December, 1909, after several months spent in the qualitative work described in Part II (*Electrical World,* Dec. 14, 1912, page 1262). As a result of the preceding work the authors had discarded the filter-paper voltameter as an instrument of precision and had turned their attention to the problems related to the porous-cup form and the purification and testing of the electrolyte. The apparatus and methods employed were similar to those previously described.

During this period of the work the small porous-cup voltameter was found to be the most convenient and reliable form to use as a standard. With the purest salt available the deposits were adherent and white, always non-striated, and crystalline as seen under the microscope. As a test of the reproducibility of this small porous-cup form, there were tabulated fifty-four deposits, made in pairs (except two sets of three each), in each pair the electrolyte and other conditions being made as nearly identical as possible. The average deviation of each value from the mean of each group of two or three cups was found to be one part in 100,000. That is, when the variations in the electrolyte and the measurement of current and time are eliminated so that it is simply a question of how nearly two similar voltameters agree with one another—the variations being produced by loss of silver in washing the deposit, fluctuation in moisture or impurity in the deposit, and errors in weighing the cups—the average deviation of individual values from the mean shown by two or three cups is only 0.001 per cent.

Comparison of the large porous-cup voltameter with the smaller size showed consistently a heavier deposit in the former by about five parts in 100,000, and the siphon form, which required a very large volume of electrolyte, gave a still greater excess. It was at length discovered that this excess of deposit in the larger sizes was roughly proportional to the volume of the electrolyte and the authors have called this the "volume effect." It seemed probable that this was due to traces of impurity which had not been eliminated from the electrolyte, and this suspicion led to an extended investigation of the purifying and testing of silver nitrate. As a result of this work, electrolyte was prepared which satisfied all the criteria for purity and brought the large sizes of voltameters into agreement with the small porous-cup voltameter, thus justifying its previous use as a standard form. The effect of slight contamination of the electrolyte in this small size must have been almost negligible, as the results obtained with it have been amply justified by subsequent work. As the experiments progressed the "volume effect" was found to be a very useful indication of the purity of the electrolyte, revealing the presence of impurities too small in amount to affect visibly the crystalline structure of the silver deposit. It is not claimed that this phenomenon of heavier deposits in large voltameters is a new discovery, for it was observed in the work of Lord Rayleigh nearly thirty years ago and has been ascribed to various causes, but the authors do believe that its significance has not been appreciated before nor the correct explanation for it given.

Using the mean of forty-four of the most reliable determinations made in the small porous-cup form of voltameter during the period from December, 1909, to April, 1910, the authors have obtained for the Weston normal cell at 20 deg. C., on the present basis, the value 1.01827$_5$ volts. This is very close to the value recorded in the first series of measurements and is probably more reliable.

Several determinations were made in which two voltameters maintained at 50 deg. C. by external heating coils during the passage of the current were compared with two similar voltameters at room temperature (about 20 deg. C.). The results indicate that there is no temperature coefficient, a fact which Kohlrausch and Weber have also shown in a different way. It is believed that the reason other observers have found increased deposits in voltameters at higher temperatures is because the chemical activity of impurities in their electrolyte would naturally increase with the rise in temperature.

Two gold dishes, similar in design to the smaller platinum dishes previously used, were purchased for comparison. By tabulating the differences in deposit between the gold and platinum cathodes in each case where no other differences in the voltameter existed, it was found as a result of twenty-nine comparisons that the deposits in the gold dishes were lighter by 1.4 parts in 100,000, which may be regarded as indicating the substantial agreement between the two materials.

Some further work was done with the Poggendorff form, but the results were not encouraging. Hence attention was directed chiefly to the forms that had proved more reliable and to the purification and testing of the electrolyte in anticipation of the co-operative work with the English, French and German national laboratories, begun at Washington April 1, 1910.

The most difficult problems connected with the preparation of silver nitrate for use in the voltameter are concerned with the exclusion or removal of reducing impurities and colloidal silver, on the one hand, and of uncombined acid and base on the other. The tests that have been developed for determining the acidity of the solution are for the purpose of determining the uncombined acid or base rather than the absolute hydrogen-ion concentration.

The usual methods of testing the neutrality of salts do not apply to silver nitrate. Thus, toward litmus a silver-nitrate solution will react as alkaline, even after the addition of one part in 100,000 of nitric acid. A similar solution will react acid toward methyl orange after the addition of alkali, provided the silver is not completely precipitated. Other indicators also were tried. If the silver be precipitated from the silver nitrate solution by a neutral KCl solution and the AgCl precipitate filtered off on asbestos, the filtrate will show a neutral reaction toward the various indicators if the original $AgNO_3$ contained no uncombined acid or base. By using iodeosine as an indicator so little as one part in 1,000,000 of nitric acid (or alkali) added to the original $AgNO_3$ can be detected in the filtrate by titration with (N/1000) HNO_3 or NaOH. The results have been expressed in terms of parts per million of the nitric acid.

For the detection of reducing impurities (principally cellulose hydrates from filter paper), and of colloidal silver, a titration test with (N/1000) $KMnO_4$ solution has proved very valuable. The slightly acidified crystals of silver nitrate are fused as will be described for purifying the salt, and then dissolved in water to form a 66 per cent solution. Ten cubic centimeters of this solution is acidified by adding 1 cu. cm of concentrated nitric acid (free from nitrous acid) and the N/1000 potassium permanganate solution added in 0.5 cu. cm portions until the pink color persists for five minutes or more. The number of cubic centimeters thus required the authors have called the "permanganate number" of the silver nitrate. In test cases this has been found to be proportional to the amounts of oxycelluloses previously added to the silver nitrate and very minute traces can thus readily be detected. It is not claimed that the organic material is necessarily oxidized completely, but nevertheless the method is much more sensitive than any method of direct combustion would prove under the circum-

stances, as well as being more expeditious. By titrating these concentrated solutions of silver nitrate less than 0.001 per cent of colloidal silver may be detected, a result that is of particular value in showing when over-fusion of the salt has occurred in its preparation.

The water used was twice distilled in block tin and was kept in bottles of especially prepared resistant glass. Samples were frequently tested for conductivity and alkalinity. These values were, on the average, about 1.3×10^{-6} reciprocal ohms and 0.6 parts in 1,000,000 respectively. The water in the stills was boiled by steam under pressure, thereby avoiding the possibility of contamination by CO_2, which may greatly increase the deposit in the voltameter.

For purifying the silver nitrate for use in the voltameter it is convenient to start with the best chemically pure salt obtainable from the manufacturing chemists. If this salt is repeatedly recrystallized from neutral solution, the resulting product shows a tendency to become basic, which under certain conditions gives rise to the volume effect in the voltameter. To avoid this condition it is necessary that the last mother-liquor should be acid to the extent of from 0.1 to 1 per cent of the water present, depending on the efficiency of the draining. In the present work a porcelain centrifuge has been employed and the crystallization carried out in porcelain, quartz and platinum vessels without any significant differences in the final product. It is best that the preliminary recrystallizations should be made from strongly acid solutions, as this increases the yield of crystals owing to the less solubility of the $AgNO_3$ and decreases the number of crystallizations required to satisfy the permanganate test.

Salt yielding the same result in the voltameter has also been prepared by recrystallization from strongly acid solution and subsequent fusion. The fusion appears to break up the more resistant impurities contained, and in some cases these come to the surface and may be readily removed by washing the surface of the fused cake as suggested by Mr. F. E. Smith. The fusion also furnishes a ready means of controlling the amount of acid in the final product, but especial precautions must be taken to avoid decomposition. Whether the silver nitrate is decomposed by heat when fused seems to depend less on the temperature than upon the amount of acid retained by the melted salt. As soon as the last trace of acid is expelled the salt begins to decompose into silver oxide and colloidal metallic silver, as shown by the tests with iodeosine and potassium permanganate respectively. By removing the salt from the furnace as soon as the last trace of solid material has melted it is found that a small amount of acid (one or two parts in 100,000 of the solid salt) is retained. This is sufficient to prevent decomposition and in a 10 per cent solution is negligible in the voltameter.

Salt prepared in this way, which is satisfactory for the voltameter, is invariably of a beautiful pearl white and is never darkened, as noted by some earlier observers. The reasons why the salt, when recrystallized and fused according to the well-known researches of Richards and Forbes, although well suited for their purposes of atomic-weight determinations, is not suitable for use in the voltameter can be given adequately only in the complete paper to be published in a *Bulletin* of the Bureau of Standards. It must suffice here to say that the authors have carefully followed their procedure and found the product unsuited for the voltameter—first, because of the slight decomposition resulting from the prolonged fusion, and, second, because of the basicity formed from the repeated recrystallizations from neutral solutions.

In the fourth and last paper of this series the results subsequent to the work of the International Technical Committee will be given. These include experiments, made with the highest precision, to determine the value of the Weston normal cell, and also a discussion of the action of acid and base in the voltameter.

Public Service Commission News

NEW YORK COMMISSION

The Public Service Commission of the Second District has directed the Granville Electric & Gas Company to reduce its present residence electric-lighting rate from 15 cents per kw-hr. so that for like service the rates shall not exceed the company's present so-called commercial rates, which are on the basis of 13 cents per kw-hr. for the first 20 kw-hr., 12 cents for the next 30 kw-hr., 10 cents for the next 50 kw-hr., and all in excess of this 8 cents per kw-hr., with a discount of 10 per cent for payment within fifteen days. The commission holds that the evidence as presented in the case discloses discrimination between residence and business lighting. The opinion further states: "No reason appears why the company should maintain a higher rate for house service, and accordingly its 15-cent rate for residences should be reduced to 13 cents per kw-hr. It should also reduce its residence rate for larger quantities to correspond with its business rates. This ruling applies only to the facts and conditions shown in this case, and may or may not be applicable in other cases, being dependent upon the particular facts appearing herein."

MASSACHUSETTS COMMISSION

An exhaustive report recommending the closer control of holding companies has been submitted to the Massachusetts Legislature by the special commission appointed to investigate the status of voluntary associations. Among the parties to the commission were the members of the Board of Gas and Electric Light Commissioners and the Railroad Commission. The joint commission recommends the passage of five bills for the further regulation of holding companies. The first bill provides that no business corporation shall hereafter purchase or hold, directly or indirectly, more than 10 per cent of the stock of a Massachusetts public-service corporation. The second bill gives the Railroad and Gas and Electric Light commissions all books, accounts, contracts, etc., of any voluntary association holding the stock of a Massachusetts public utility, and an important section provides that the act shall not be construed as requiring or justifying either board in taking into consideration the total capital stock of the holding company or trustees in fixing the rates charged by or the service furnished by subsidiary companies.

A third bill provides that no person, partnership or association owning or controlling public-utility shares shall hereafter use any name or title which, in the opinion of the commissioners having regulative authority, might lead the public to believe that such owners or controllers of shares were in themselves, or were conducting the business of, a public-service corporation. A fourth bill provides a penalty of fine or imprisonment for any trustee of a holding company who fails to file a copy of the trust agreement of such association with the commissioner of corporations. The fifth bill provides for the annual publication of all declarations of trust and amendments or additions thereto which have been filed with the corporation commissioner. This publication is also to contain such information as may be transmitted by the Gas and Electric Light or Railroad commissions in regard to such companies.

In the course of its report the special commission points out that there are in Massachusetts seventeen voluntary associations and two corporations organized for the purpose of holding public-service securities. Of these, eight concern railroads or street railways and eleven concern gas or electric companies. Most of these have shares outstanding in number considerably in excess of the shares of the subsidiary companies, the properties being in some cases widely separated physically. In at least two instances public service corporations are associated with ordi-

nary trading corporations, from which the former purchase materials, supplies or services. The report reviews the established policy of the State not to allow the issuance of securities in excess of actual requirements by public-service corporations, and points out that such securities are issued only under the authority of the commissions having regulative powers. While authority is generally given to gas companies to engage in the supply of electricity, a purpose to forbid the merging of gas and electric companies expressly appears in the recent acts authorizing the consolidation of gas companies and electric companies respectively. A similar hostility also exists with regard to the merging of street railways with railroads. In the general laws authorizing consolidations they are confined to properties actually connected or operating in adjoining municipalities and are subject to the approval of the supervising commission.

The commission points out that the policy of the State is to keep the authorized capital stock as low as the market and other conditions warrant, to prevent the capitalization of surpluses accumulated out of earnings, to withhold authority to consolidate public services different in character and to limit consolidations to properties capable of becoming integral parts of one enlarged system. It is intended to create and preserve a status favorable to low rates and good service by rigid restrictions upon the issue of securities and by authorizing direct interference with rates and service. While discouraging competition between companies engaged in the same business, it plainly proposes to preserve such degree of competition as may result from the independent operation of railroads and street railways and of gas and electric light companies serving the same communities. The holding-company plan invites the taking of a heavy toll from the public, and may prevent or delay the normal advantages which might accrue to the public from the voluntary action of the subsidiary companies in the reduction of rates and improvement of service. When such a relation includes a trading company dealing in supplies or materials, the result may be a loss of that freedom of contract hitherto regarded as of inestimable value. It appears to the commission that any action toward regulation of holding companies by the supervising boards might tend to give a deceptive value to the shares of voluntary associations now outstanding and might still further mislead the investing public. The report points out that, while the prime purpose of laws for the public supervision of public utilities is to protect the consumer rather than the investor, the interests of both will be conserved by requiring from these holding companies such information as may be necessary in the public interest or for the successful regulation of their subsidiaries, and by compelling them to adopt such name as may clearly distinguish them from the operating companies which they control.

Wisconsin Commission

The Wisconsin Railroad Commission has granted the application of the municipal electric light and water plant of Arcadia for an increase in rates on the ground that increase in operating expenses due to the rehabilitation of the plant and increase in salaries, with an accompanying decrease of 33 per cent in output occasioned by the general introduction of tungsten lamps, has reduced the net revenues to an unreasonably low figure. The present rates consist of a meter rate of 5 cents per kw-hr. for commercial lighting and 6 cents per kw-hr. for street lighting. The rate of 7 cents, as requested by the petitioner, was considered insufficient and the following schedule was ordered: Primary rate, 11 cents per kw-hr. for the first thirty hours' use a month of the active connected load; secondary rate, 8 cents per kw-hr. for the next sixty hours' use; excess rate, 6 cents. In residences the active load is to be taken as 60 per cent of the total connected load when the total connected load is equal to or less than 500 watts; when the installation exceeds this value, 33⅓ per cent of the excess is to be taken as active. In stores, banks, business and professional offices, etc., 70 per cent of the connected load up to 2.5 kw is to be regarded as active, as well as 55 per cent of the load in excess of this value. In county and State buildings, schools, churches, factories, etc., 55 per cent of the total connected load is to be active. The minimum bill was increased from 50 cents to 75 cents, and the rate for street lighting was fixed at $4.25 per 60-cp tungsten per annum, plus a charge of 5 cents per kw-hr. for energy consumed.

The electric light plant at Chetek has been authorized to increase its rates for commercial lighting by about 16 per cent, exclusive of the excess rate, the latter being increased 100 per cent.

The commission, on its own motion, has investigated the rates and regulations of the municipal electric light and water plant at Evansville and has ordered the utility board to establish the following schedule for commercial lighting: Primary rate, 11 cents net for the first ninety hours' use per quarter of the active connected load; secondary rate, 7 cents net for the next 180 hours' use per quarter; excess rate, 5 cents. The consumers are to be divided into classes according to the percentage of active connected load in a manner similar to that obtaining at Arcadia, noted above. The rate for motor service was decreased from a flat rate of 6 cents per kw-hr. to a rate of 5 cents per kw-hr. for the first ninety hours' use per month, all in excess being charged at the rate of 4 cents per kw-hr.

Ohio Commission

The Public Service Commission of Ohio has ordered the Middletown Gas & Electric Company to amend its long-hour lighting and breakdown lighting rate and to substitute instead two rates, one relative to long-hour lighting, to be the same as that now in force, and the other relative to breakdown service, to be as follows: A minimum charge of $3 a month per kva of demand and all energy consumed during any month to be charged according to the following scale: Up to 150 kw-hr., 10 cents a kw-hr.; from 151 to 300 kw-hr., 9 cents a kw-hr.; from 301 to 600 kw-hr., 8 cents a kw-hr., and for all energy above 600 kw-hr., 7 cents. Where the account is paid by the tenth day of the succeeding month a discount of 10 per cent must be allowed and the minimum charge is to apply in payment for energy used. The company is also required upon the written request of any customer to make a re-measurement of the demand without charge, though this need not be done more than four times a year. The order becomes effective Feb. 1, 1913.

Oregon Commission

On Dec. 27 and 28 the Railroad Commission of Oregon held preliminary meetings with the various utility corporations of that State, conferring with representatives of electric power and light and street-railway systems the first day and with the delegates from gas, telephone and telegraph companies the second day. As a result of the meetings committees were appointed representing the various utilities, which will draw up proposed rules and regulations governing various services, together with proposed accounting systems and uniform classifications of accounts. These will be submitted to the Railroad Commission in the shape of reports and the Railroad Commission will then hold public hearings on the proposed rules and accounting systems. It is expected that the rules and regulations adopted by the Oregon commission will be very similar to those adopted by the Washington commission. The Railroad Commission of Oregon has already issued its instructions relative to filing of tariffs, and a number of companies have already filed their rate schedules.

Washington Commission

The Public Service Commission of Washington has published its standard classification of property, construction

and operating accounts for power, light and water companies and also for street railways, and it is expected that a classification will soon be issued for gas companies. The classification adopted by the Washington commission was prepared by representatives of the Northwest Electric Light and Power Association. The classification adopted is based quite largely on the Wisconsin classification but also contains features from the National Electric Light Association classification. After it was recommended by the Northwest association the Washington commission held a public hearing and made a few changes and then published the classification as an order of the commission. The gas-company classification of accounts is being held up temporarily, but it is expected that it will soon be published.

NEW JERSEY COMMISSION

The Board of Public Utility Commissioners has ordered the Public Service Gas Company to reduce its rates in the Passaic division from $1.10 to 90 cents per 1000 cu. ft. and has recommended that the company make the same rate throughout all of the other divisions of the State. The board also recommended that the company's schedule of quantitative discounts be readjusted in accordance with the new rate. The board's decision in this matter makes no allowance for "good will" but recognizes "going concern value" as entering into the base upon which the utility is entitled to earn a fair return.

Current News and Notes

EXPORTS OF TELEPHONE EQUIPMENT.—Telephones have been separately listed in the export statistics of the United States only since the middle of 1911, but sufficient data have already been obtained to justify the statement that the telephone exports of 1912 amounted to more than $1,000,000 in value.

* * *

PARIS TO WASHINGTON BY "WIRELESS."—The new United States Navy radio-telegraph station at Arlington, near Washington, D. C., recently picked up a wireless time signal from the Eiffel Tower station of the French government at Paris. In addition to the signal, the word "Eiffel" was distinctly received before communication was broken. The distance from Paris to Washington is nearly 4000 miles.

* * *

LOSS OF SHAWNEE (OKLA.) OFFICES BY FIRE.—Fire which gutted the Pottawatomie Building at Shawnee, Okla., Dec. 26, destroyed the offices, salesroom and storeroom of the Shawnee Gas & Electric Company, which occupied the greater part of the first floor. The company was able to save all its important books and records, according to Mr. F. W. Caldwell, general manager, and promptly opened up a new office across the street at 113 North Broadway. The loss is well covered by insurance.

* * *

TWENTY-FIVE-CYCLE EQUIPMENT TO BE USED ON THE CANAL ZONE.—The Balboa electric plant on the Canal Zone has been closed as a generating station and the Balboa territory will be supplied from Miraflores. Twenty-five-cycle, three-phase equipment will replace the 60-cycle apparatus now in use in the Ancon district, and henceforth all alternating-current motor and lighting installations on the Zone will be operated by 25-cycle energy. The cranes on the pier at Balboa and the overhead crane in the Balboa shops will be operated from the Balboa plant by a motor-generator set. Otherwise, the Balboa station will be used solely as a distributing center.

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GERMAN, BRITISH AND AMERICAN ELECTRICAL EXPORTS.—During 1911 the total value of electrical goods exported from Germany amounted to $52,558,000 and that of imports to $11,436,000, a rise from $7,056,450. The exports of electrical machinery and appliances from the United States during 1911 were worth in round figures about $19,329,000, as against $16,547,300 in 1910. The exports from Great Britain for 1911 comprised $13,720,000 worth of electrical goods and apparatus, $8,714,500 worth of electrical machinery and $254,500 of electrical porcelain ware, a total of $22,689,000. The imports under these classifications were valued at $6,986,000, $5,114,000 and $191,000, a total of $12,291,000. For 1910 the British total exports were $28,246,000 and the imports $11,217,285.

* * *

COOKING BY ELECTRICITY.—At a meeting of the Swedish Technological Society at Stockholm on Dec. 14, 1912, Dr. Alfred Ekström delivered a lecture on "Cooking by Electricity." Demonstrations were made with a new electric stove somewhat similar to the Copeman stove made in this country, but containing a number of improvements patented by Dr. Ekström. From extensive experiments in a household of twelve persons, the speaker concluded that cooking and baking by electricity on this stove was 35 per cent cheaper than on a wood stove. Identical meals were cooked in each way, under equal conditions, and the cost was figured in both cases with electricity and wood at market price, that is 2.75 cents per kw-hr. for electricity and $10 per cord of 128 cu. ft. for hard wood.

* * *

GREATER CHICAGO TERMINAL PLAN INVOLVES ELECTRIFICATION.—At a luncheon of the City Club of Chicago on Jan. 4 Mr. Jarvis Hunt, architect, explained his plan for a joint passenger and freight terminal for the through-route business of all the railroads entering Chicago. The "Greater Chicago Terminal Plan," as Mr. Hunt calls it, provides for a new channel for the South Branch of the Chicago River 175 ft. east of Canal Street, the terminal to be bounded by West Twelfth Street, South State Street, Archer Avenue and the new channel of the river. It is arranged for a loop rather than a stub-end terminal, the incoming and outgoing traffic to be entirely separate. The ultimate capacity would be 600 trains an hour. The speaker said that unquestionably such a terminal would be accompanied by electrification of the trackage leading to it. Railroads coming in from the south, west and north respectively would be combined in a few great terminal arteries, and these could be electrified with comparative economy.

* * *

DEPARTMENT OF ELECTRICITY SECURES INCREASED APPROPRIATION.—By a recent decision of the Supreme Court of Illinois, the city of Chicago at the time of making up its annual budget faced a deduction in its expected revenue of approximately 20 per cent. Until remedial legislation could be obtained from the Legislature it was necessary for the city authorities to practise the greatest economy. Temporarily the city officials, from the Mayor down, found it necessary to accept a 20 per cent reduction in salaries. In this situation it is interesting to note that the Department of Electricity, which has charge of the city street lighting, received an appropriation even larger than that of last year. The amount set aside for this department a year ago was about $1,480,000, while the figure included in this year's budget is $1,675,000. This will enable the Department of Electricity to carry out its contract with the Sanitary District for increased electric street lighting. An effort was made in the City Council to reduce the item for supplies for the Department of Electricity from the $103,000 which was asked to the $60,000 of last year. Mr. Ray Palmer, the city electrician, explained, however, that without this increased appropriation it would probably be necessary to discontinue the operation of a portion of the increased street arc-lighting service next summer. The aldermen felt that the need of better street lighting was so urgent in Chicago that the increased appropriation should be allowed.

The "Bathtub" Case.—The retrial of the criminal anti-trust suit against the so-called "Bathtub Trust" will be commenced early next month in Detroit. In the first trial the jury disagreed and the government delayed retrial until the Supreme Court decided the issues involved in the civil case. The decision of the Supreme Court was reported very fully in our columns on Nov. 30, 1912, page 1131. That decision ordered the dissolution of the combination of sixteen corporations and sixty-four individuals, manufacturers of enameled ironware.

* * *

Water Supply of the St. Lawrence River.—Water Supply Paper No. 304, issued by the United States Geological Survey, comprising part of a series dealing with the surface water supply of the United States, is entitled "Part IV. St. Lawrence River Basin." This was prepared under the direction of Mr. M. O. Leighton by Mr. C. C. Covert and Mr. R. H. Bolster. The publication is devoted mainly to the presentation of stream-flow measurements made during the calendar year 1911 upon streams tributary to the Great Lakes and the St. Lawrence River.

* * *

Lectures on Industrial Hygiene.—The public health education committee of the New York County Medical Society will give a series of lectures on alternate Wednesday evenings and Thursday afternoons from Jan. 8 to March 27, 1913, in which are included three lectures on industrial hygiene. These will be given Wednesday, Feb. 19, at 8:15 p. m., and include one on "The Benefits of Accident and Disease Prevention Among Working People," by Mr. Arthur Williams; another on "Industrial Hygiene and Lighting," by Mr. L. B. Marks, and a third on "Safety Appliances and Prevention of Accidents," by Dr. William H. Tolman, of the American Museum of Safety. The lectures are to be held at 14 West Forty-third Street, New York, and are open to the public.

* * *

Large Single-Cylinder Internal-Combustion Engine.—According to a recent announcement, a German firm is now prepared to furnish an internal-combustion engine of a type in which 4000 hp can be generated in one cylinder. The announcement has reference to a marine type of engine using oil fuel, but undoubtedly the advances in design which have made possible such large single-cylinder units are applicable also to stationary practice. At the present time the limit of output in single-cylinder units is in the vicinity of 300 hp to 400 hp. The new unit is said to be of the two-cycle double-acting type. It has been known for some time that several German firms have been very active in developing high-power internal-combustion engines for use with oil fuel, but it has been very difficult to obtain authentic information regarding what has been accomplished. Competition from the Diesel type of engine and the extensive preparations under way or completed by many manufacturers for turning out large engines of this type have been undoubtedly a potential factor in stimulating the efforts of the German builders to develop successful oil engines in large units.

* * *

SOCIETY MEETINGS

Meeting of Operating Engineers.—At a meeting of the Institute of Operating Engineers to be held at 8 p. m. on Jan. 25, in the Engineering Societies Building, New York, Mr. Arthur K. Ohmes will deliver a lecture on heating and ventilation.

* * *

Wood Preservers' Convention.—The ninth annual meeting of the American Wood Preservers' Association will be held in the Hotel Sherman, Chicago, on Jan. 21-23. A number of papers relating to wood preservation will be presented and discussed. According to the program, the treatment of poles and cross-arms will come up on the afternoon of Jan. 22.

Electric Club of Chicago.—At the meeting of the Electric Club of Chicago held on Jan. 2 a committee was appointed to nominate officers for the ensuing year, action to be taken on these nominations at the election to be held on Feb. 6. This committee consists of Messrs. F. S. Hickok, D. W. Roper and H. A. Mott.

* * *

Meeting of New York Companies' Section, N. E. L. A.—At the next meeting of the New York Companies' Section, N. E. L. A., Jan. 20, President F. M. Tait of the N. E. L. A. will be speaker, his topic being "Association Affairs." Mr. W. J. Burns, the noted detective, is also scheduled to relate some of his famous experiences.

* * *

January Meeting of Chicago Section of the Institute.—A paper on "The Principles of Regulation and Methods by Which Public Utility Laws Are Enforced" will be read by Mr. Halford Ericson, a member of the Railroad Commission of Wisconsin, before the Chicago Section of the American Institute of Electrical Engineers on Jan. 27, in the rooms of the Western Society of Engineers.

* * *

Sons of Jove at New York.—At the Wednesday noon luncheon of the Sons of Jove, Hotel Imperial, New York, Jan. 8, Mr. George F. Parker, manager of the New York Electrical Show, addressed the 100 members present. Mr. Frank M. Tait, president of the Dayton Electric Lighting Company, of Dayton, Ohio, and president of the National Electric Light Association, is to be the guest of the club at its next meeting, Jan. 22.

* * *

Preparation for Inspectors' Convention at St. Louis.—St. Louis electrical men are preparing to entertain the Western Association of Electrical Inspectors when that association holds its annual convention in St. Louis on Jan. 28 to 30. The St. Louis League of Electrical Interests will give a dinner in honor of the inspectors on Jan. 28, and there will be a rejuvenation of the Jovian Order on Jan. 29. Mr. W. J. Canada, of Denver, is president of the Western Association of Electrical Inspectors, and Mr. W. S. Boyd, of Chicago, is the secretary. Mr. James H. Fenton is the chairman of the St. Louis committee of arrangements.

* * *

Philadelphia N. E. L. A. Section Activities.—At a meeting of the commercial branch of the Philadelphia Electric Company Section, N. E. L. A., Dec. 30, Mr. C. J. Russell discussed the definition and importance of various central-station factors. Mr. J. W. Howell, of Harrison, N. J., addressed the regular section meeting of Dec. 16 on the subject of incandescent lamp development. New apparatus and devices were also exhibited. At the accounting meeting of Dec. 12 Mr. Gershom Smith, Washington, D. C., took for a subject the relation of team play to modern business efficiency. Protective devices for meter installations was the topic of the December session of the meter-department branch, held earlier in the month, when a paper by Mr. G. R. Smith, of Brooklyn, N. Y., was read.

* * *

Chicago Association of Commerce Committees.—In the new ways and means committee of the Chicago Association of Commerce the sub-committee on electrical goods, fixtures and wires consists of Mr. J. A. Bennan, of the Thordarson Electric Manufacturing Company, chairman; Mr. Louis A. Schwab, Monarch Electric & Wire Company, vice-chairman, and Messrs. H. L. Grant, Western Electric Company; J. W. Bolte, Bolte & Weyer Company, and Frank Horton, Moran & Hastings Company. The sub-committee on public utilities consists of Mr. A. R. Bone, Chicago Telephone Company, chairman; Mr. Britton I. Budd, Chicago Elevated Railways, vice-chairman, and Messrs. George B. Foster, Commonwealth Edison Company; John Fitzpatrick, Western Union Telegraph Company, and Henry N. Foster, Chicago Telephone Company.

Hydroelectric Plant at Trollhättan, Sweden

100,000-hp generating station built by the Swedish government for supplying energy at low rates for muncipal purposes and ultimately for traction

ONE of the largest water-power developments in Europe has recently been carried through by the Swedish government at Trollhättan, a well-known tourist resort, which for years has attracted thousands of visitors from all over the world by the beauty of its scenery. The water-power possibilities of the locality have long been recognized, but it was only after many years of litigation that the right of the government to utilize the waterfalls at that place was finally settled by the courts. A short description of the project was given in the *Electrical World* in the issue of Aug. 11, 1910.

The Trollhättan falls, which are among the largest in Sweden, are located on the Göta River, about 40 miles from Gothenburg. This river is the only outlet of Lake Vänern, the largest lake of the country and the third in size in Europe. Its area is 2150 sq. miles. The stream flow in the river varies between a minimum of 11,500 cu. ft. per second and a maximum of 32,000 cu. ft. per second. With the proposed regulation of Lake Vänern, the water level can readily be raised and the minimum flow materially increased, and it is estimated that in this way not less than 200,000 hp may be obtained. A view of the Göta River looking down stream from the last of the chain of falls is shown in Fig. 1.

FIG. 1—VIEW OF LOWER FALLS AT TROLLHÄTTAN WITH SITE OF PRESENT PLANT TO THE LEFT

With an available head of 108 ft. and a flow of about 9000 cu. ft. of water per second, which is the amount for which the present installation was planned, approximately 100,000 hp can be developed. The completed generating equipment now in operation comprises three-fourths of this amount. The bulk of this power is transmitted to Gothenburg, the leading city on the west coast and the second largest city in Sweden, while the remainder is either transmitted to various other cities or is utilized by the different manufacturing establishments in the immediate vicinity. It is the intention to use a large amount of power of the future development for railroad electrifications and for electric reduction of iron ore.

The regulating dam is constructed across the river about 400 ft. below the water intake to the power canal. This dam is built on firm rocks and is provided with four openings separated by granite piers. The two center openings each have a width of 65 ft. and may be closed by means of bear-trap or roller gates, while the other openings in the dam are closed by six ordinary sluicegates which can be drawn up or let down as desired. Both the bear-trap gates and the sluicegates are geared to electric motors and can be operated either electrically or by hand power.

The intake from the river to the power canal consists of six openings, each about 40 ft. wide, separated by granite pieces of 6.5 ft. thickness. A floating ice guard, built of strong timber and fitted with a screen, is placed in front of the openings.

The power canal, which is about 4250 ft. long, is partly blasted in the solid rock and the remaining portion constructed of concrete. The intake and the first 1150 ft. of the canal have a section permitting a stream flow of 12,500 cu. ft. per second, while the remainder allows a flow of only 9000 cu. ft. per second. With the regulation of Lake Vänern and the contemplated increase in the development decided upon, the present ship canal may be utilized as a power canal, the old ship canal then being abandoned for the use now made of it and superseded by a larger one. A canal permitting a stream flow of 3500 cu. ft. per second will then be built connecting this old ship canal with the power station and also with the present power canal. Provision has already been made for such a branch, and a gate has been installed having a width of 56 ft. and a height of 30 ft.

The distributing reservoir is located close to the power station and was blasted in the rock. On the two short sides of this reservoir there are provided overflow outlets to prevent an inundation of the power station in case a number of the waterwheel governors should simultaneously be closed. A handsome building, shown in Fig. 3, is provided for housing the gates and guards for the penstock inlets. Each turbine unit is supplied by a separate penstock which emerges from a separate chamber in the gatehouse and is provided with sluicegates and ice guards, the former being provided either for manual operation or for electric remote control from the switch house. There are eight penstocks for the main turbines, each having a diameter of 14 ft. and three for the exciter turbines with a diameter of 4 ft. The penstocks have a length of about 200 ft. and the larger ones are installed in separate blasted tunnels, the space between the steel tubes and the tunnel walls being filled with cement. The three smaller pipes are, on the other hand, placed in a

common tunnel. Fig. 3 shows a view of the power house in the foreground and the gatehouse on top of the hill.

Turbines

The turbines, generators and exciters form the equipment of the power station, while the transformers and the switching equipment are located in a separate building at some distance from the generating station. The ultimate equipment will consist of eight generating units and three exciter units. Six generators and all the exciters are now in operation, while the remaining two generating units are under construction. Each of the turbines has a normal capacity of 10,000 hp at 187.5 r.p.m., with an overload capacity of 12,500 hp measured at the coupling. The main turbines are of the horizontal double-runner Francis type, inclosed in a cylindrical steel casing directly connecting with the penstock as shown in Fig. 6. Almost all parts of the turbines, especially those exposed to the severest strains, are made of steel. The smallest interior diameter of the casing is 16.5 ft., the largest 18 ft., and the thickness of the material is about 15/16 in. The shaft is made of nickel steel in three parts with forged couplings bolted together. Three bearings with ring lubrication are provided and made easily accessible by means of vertical pits. All the bearings are water-cooled and are fitted with thermometers, at a convenient place outside the turbine casings, for indicating the bearing temperatures. The wheels have a diameter of 6 ft. on the inlet side and are made of cast steel securely fastened to the shaft.

A special feature in connection with the design of these turbines is the ease with which the guide blades can be independently removed. These blades are of steel, cast in one piece with their respective shafts, and in order to remove them it is necessary only to remove the section of the box belonging to the blade in question and then to uncouple the connection between the crank and the regulator. All parts of the regulating mechanism have been located outside the turbine casing so as to insure the greatest possible reliability and durability, at the same time providing for an easy lubrication and inspection of the journals during operation.

The turbine governors and the oil pumps are belt-driven from the turbine shafts. The governors are also equipped with motors so that they may be controlled from the operating switchboard. Hydraulic brakes are installed for bringing the turbines to a standstill, and these brakes are so

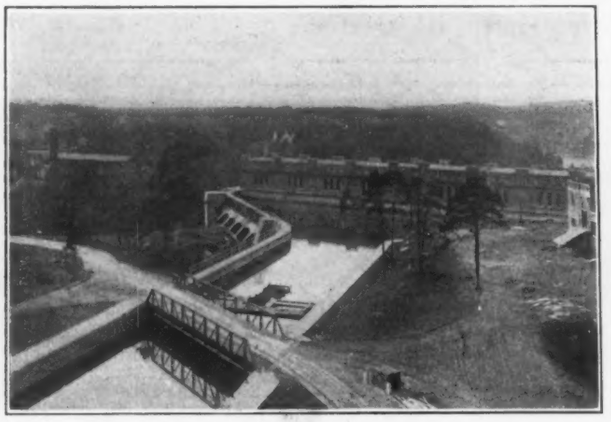


FIG. 2—DISTRIBUTING RESERVOIR AND GATEHOUSE

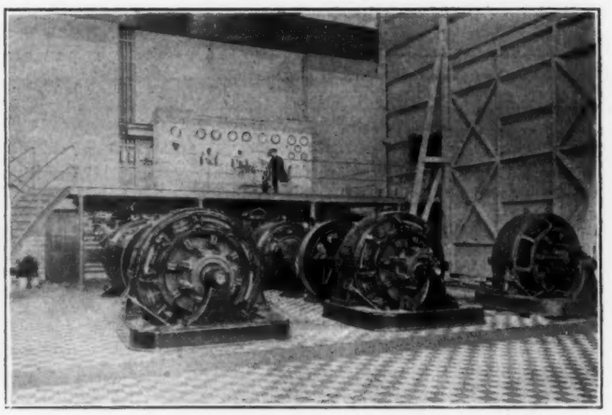


FIG. 4—INTERIOR OF EXCITER ROOM

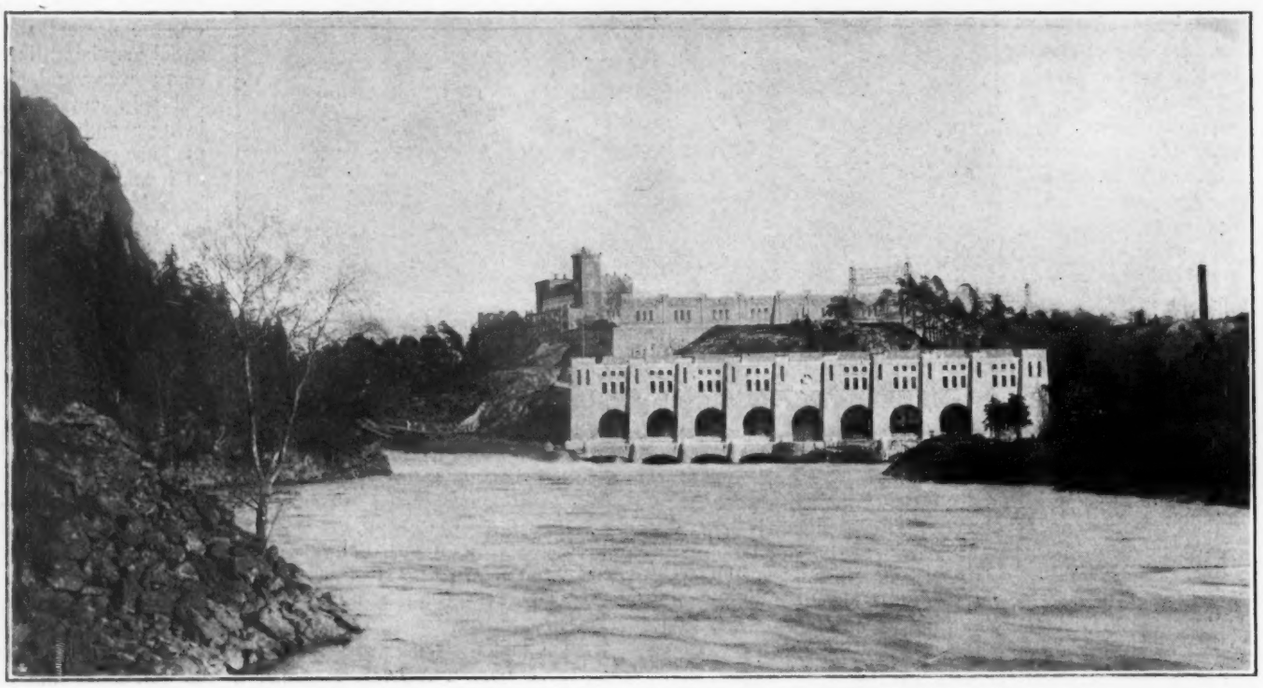


FIG. 3—GENERATING STATION IN FOREGROUND AND GATEHOUSE ON HILL

arranged that they can be operated from the starting platforms. The turbines have proved to be very efficient and actual tests have shown a full load efficiency of 87 per cent, deducting for the losses due to the pipe friction.

GENERATORS AND EXCITERS

The alternating-current generators are rated at 11,000 kva or 9000 kw at about 80 per cent power-factor. They are of the three-phase, 25-cycle type operating at 187.5 r.p.m. and delivering energy at from 10,000 volts to 11,000 volts. The design is also such that the generators will be able to deliver 6500-kw single-phase energy at 11,000 volts and 85 per cent power-factor, the reason for this being that a considerable future single-phase load is anticipated from railroad electrifications. The efficiency at 9000 kw, 80 per cent power-factor is 96 per cent, the regulation 21 per cent, and the guaranteed maximum temperature rise 45 deg. C. above the room temperature.

When delivering 11,000 kva, 11,000 volts, at 80 per cent power-factor the generators require a field current of 285 amp. This energy for field excitation is obtained from three 220-volt exciters driven by waterwheels and from a small direct-current booster generator mounted on the shaft of each alternator and connected with each field circuit. These boosters are designed so that the voltage across the generator field can be varied from 0 volt to 300 volts. No rheostats are used in the main field circuits for regulation of field current because this is entirely accomplished by regulation of the booster field current, which is supplied from the 220-volt system. A portable electrically operated field rheostat is kept in reserve and can be readily connected to the circuit in case of failure of a booster.

The main generators are of a very substantial construction, the rotor being of cast steel, the poles solid and cast with the frame, the pole faces only being laminated. Owing to its weight the frame and poles are split in three sections, at right angles to the shaft, and these parts are substantially bolted together. The shafts have been bored through their length and the core taken out to ascertain that the material used was absolutely free from any defects. The design of the rotor is furthermore such as to withstand a speed 85 per cent beyond normal. The stators are divided into two sections only and are of an entirely inclosed construction, as shown in Fig. 5. The rotor is equipped with fans which take air from the outside through inlet channels in the floor and force it through the stator and thence through outlet channels to the outside. The generators can, however, readily be changed to the ordinary open type by simply removing the inner part of the end shields.

Many advantages have been found in the inclosed type of generator construction; for instance, cold air is obtained for the ventilation; the warm air can be utilized for heating purposes and conducted to the most proper place for such use; the station need not be unnecessarily heated during the summer months, and noise is reduced to a minimum. Possibly the most novel scheme is the utilization of the heated air for heating the racks to prevent their clogging with ice during the winter months.

FIG. 5—INTERIOR VIEW OF MAIN GENERATING ROOM

The stator windings are insulated with mica and the projecting ends are substantially supported outside the core so that they may be able to withstand the strains due to short-circuits. The bearings are provided with ring lubrication and are water-cooled. The total weight of each complete unit is 220 tons, the weight of the rotor being about 75 tons.

Three waterwheel-driven exciters shown in Fig. 4, each having a capacity of 350 kw at from 220 to 300 volts and a speed of 410 r.p.m., furnish the energy necessary for excitation. The machines are of the commutating-pole type and are capable of developing 25 per cent overload. While

they are intended for a normal operation at 220 volts, they can deliver 300 volts when used for charging the storage battery which is installed in connection with the exciter system. This battery is rated 1000 kw-hr., 4800 amp-hr., at three hours' discharge. The efficiency of the exciter units at full load is 92.5 per cent.

Transformers

The transformers are installed in the transformer and switch house, which is located about 1000 ft. from the generating station. One transformer bank, rated at 11,000 kva, is provided for each generator. The transformers are of the single-phase water-cooled type, having a maximum rating of 3670 kva with a temperature rise not exceeding 60 deg. C. They are delta-connected on the low-tension side and star-connected on the high-tension side, the low-tension voltage being 10,000/11,000 volts and the high-tension voltage 50,000 volts between the phases. The guaranteed efficiency at 3000-kva unity power-factor was 98.5 per cent, and the insulation test consisted of an application of 100,000 volts between the high-tension winding and the core and of 20,000 volts between the low-tension winding and the core for a period of fifteen minutes each.

A view of the transformers is shown in Figs. 7 and 14. The core type is of especial interest, as this design of transformer has never been attempted in this country for such large sizes. The tanks are unusually substantial, being of boiler iron ½ in. thick with the seams welded. The tanks have been tested with a pressure of 10 atmospheres, and the design is such that they are absolutely air-tight and oil-tight. This makes it possible to dry the transformers under vacuum and also to prevent any damp air from entering when the volume of the oil decreases because of the cooling. A relief valve is provided which will permit the expansion or contraction of the volume of the oil. The copper cooling coils circulate 14 gal. of cooling water per unit per minute. Each transformer is provided with a ratchet-driven wheel base as shown in the illustration and, besides this, with a very complete equipment of thermometers, gages and signal apparatus for recording the temperature and oil level in the transformers. The total weight of each unit is 31 tons, the core and windings weighing 18 tons and the tank with oil 13 tons.

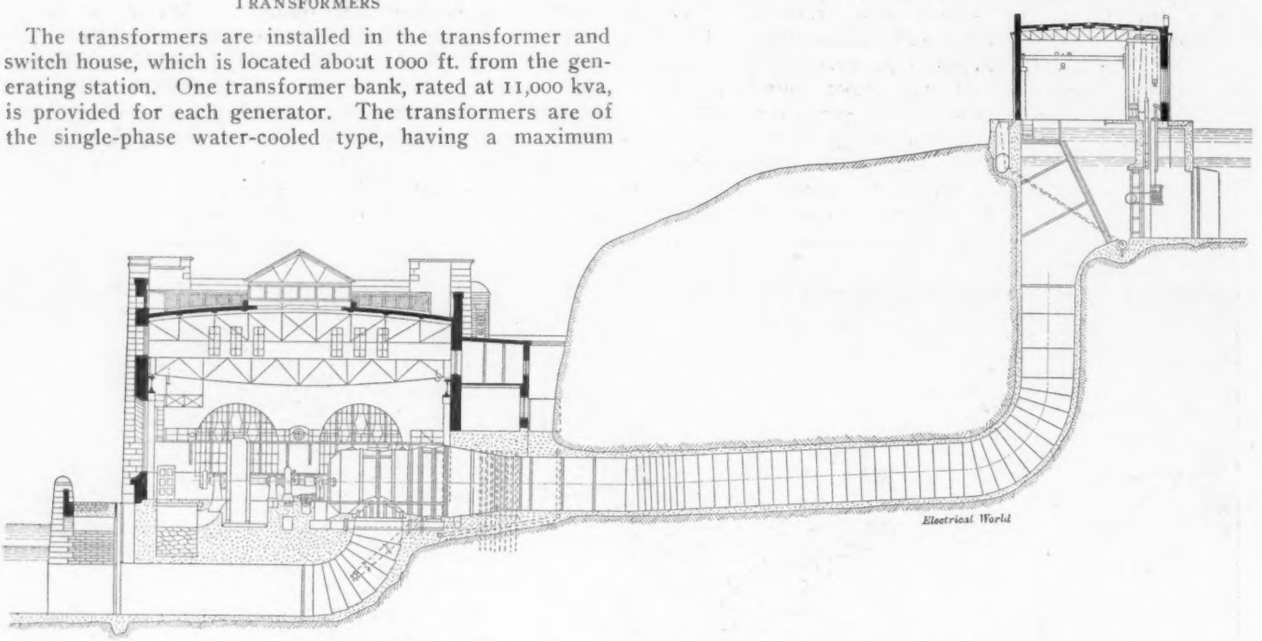


FIG. 6—CROSS-SECTION OF GATEHOUSE AND GENERATING STATION

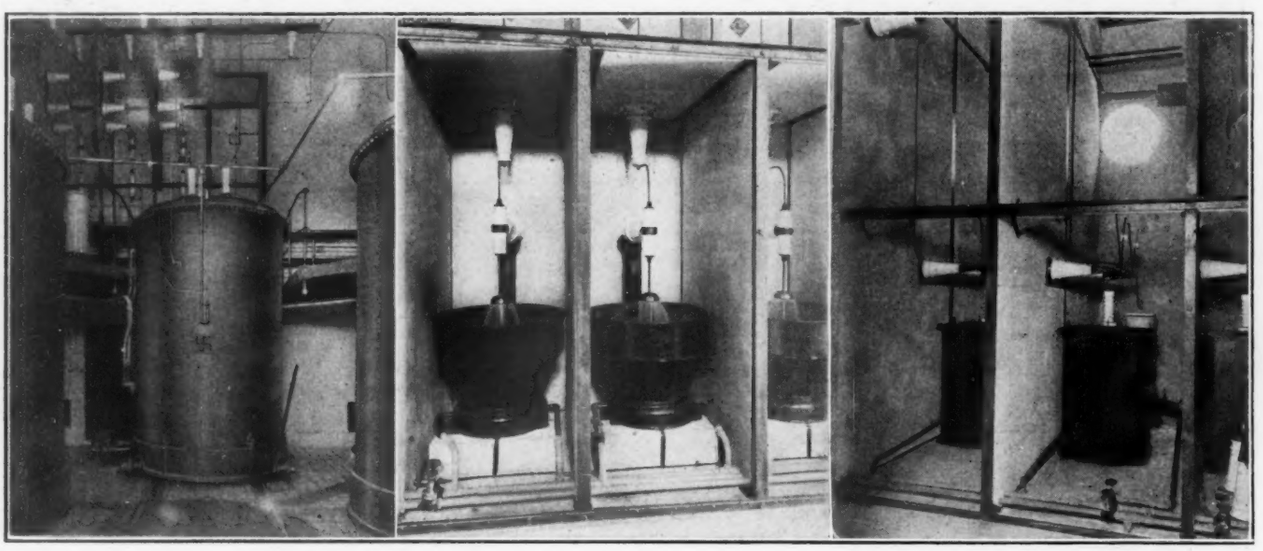


FIG. 7—3670-KVA TRANSFORMER FIG. 8—WATER-JET LIGHTNING ARRESTER FIG. 9—HORN-GAP LIGHTNING ARRESTER

Switches and Lightning Arresters

Each generator is provided with an automatic oil circuit-breaker, which is located in the generating station. The connections from this switch to the switch house consist of four three-conductor, lead-covered cables for each unit,

a tunnel being provided through which the cables are run. In the switch house (Fig. 15) the cables are again united and connected through oil switches to two sets of low-tension busbars and to the step-up transformers. The local power is taken from these buses, which can be tied together, if desired, by means of a tie switch provided for this purpose. An automatic oil switch is provided on the high-tension side of each transformer group, this as well as the corresponding low-tension transformer switch being equipped with differential relays. A set of 50,000-volt transfer buses (Fig. 12) with transfer switches of the oil-break type are installed, and each of the four present outgoing 50,000-volt lines is equipped with automatic oil switches, as are also all local 10,000-volt circuits. The system of connections is very flexible, and it is possible for each generator, with or without voltage transformation, to supply energy for any number of outgoing lines and to operate independently of the other generators. In this manner the installation can be divided into several systems independent of each other, insuring an increased reliability and safety.

The outgoing lines are provided with choke coils and double lightning protective devices. These consist of double horn-gap arresters with shunted oil resistors and series-connected water resistors, multigap and water-jet arresters, as shown in Fig. 8. Besides these, choke coils and horn-gap arresters are also inserted on the high-tension side of each transformer between each phase and the neutral point.

The switch structure is of the inclosed construction (Fig. 10), the different phases being inclosed in cells and compartments to minimize the danger of short-circuits and of accidentally coming in contact with the live parts of the system. The low-tension buses are made of copper bars and the high-tension buses of copper pipes, both being bare and mounted on substantial insulation. The buses are also provided with expansion joints to prevent insulator breakages due to expansions or contractions of the buses caused by temperature variations.

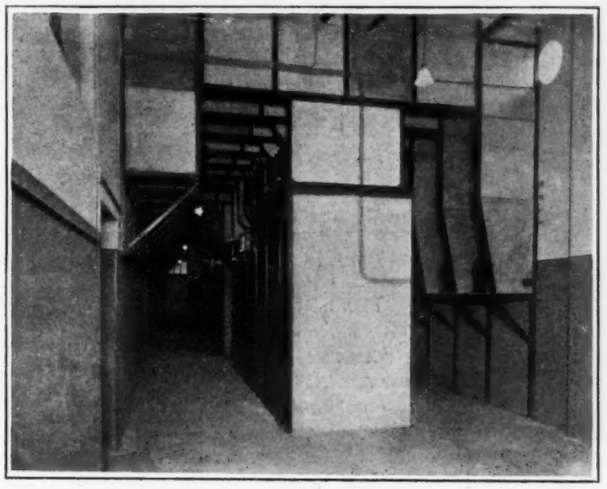


FIG. 10—SWITCH COMPARTMENTS

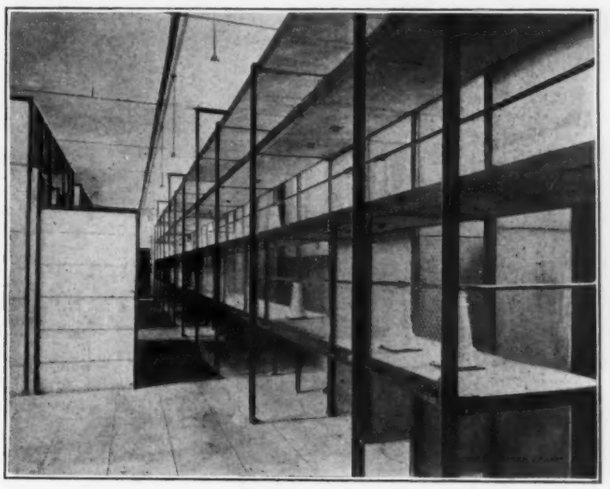


FIG. 12—HIGH-TENSION BUSBAR STRUCTURE

The two control switchboards are located in the center of the switch house. One board contains the instruments and control devices for the generator circuits, while the other is for the control of the transformer circuits and the outgoing lines. They are of marble and are made in accordance with the usual bench-type construction, as shown in Fig. 11. A separate deck containing a very complete equipment of signal apparatus is also provided, as shown in the illustration.

The design and the mounting of the oil switches are such that the oil tanks can easily be lowered, thus effecting a simple means of inspecting the contacts without dismounting the switch or emptying the oil. For the larger-type switches, as shown in Fig. 13, where the tanks are too heavy to permit being lifted by hand, a special truck is provided, which can be pushed in under the tank. It is provided with a table which can be raised or lowered either manually by a ratchet or, for the largest breakers, electrically by means of motor drive. When the tank has been

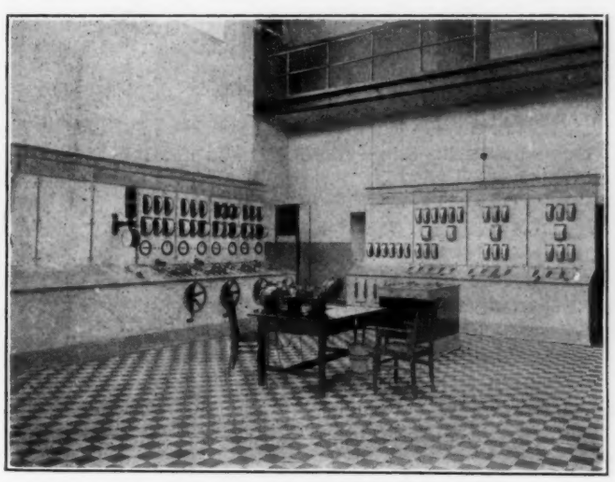


FIG. 11—CENTRAL SWITCHBOARD AND SIGNAL BOARD

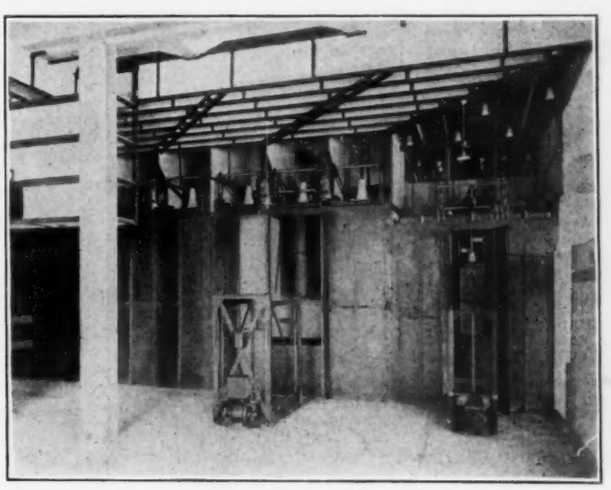


FIG. 13—OIL SWITCHES FOR 5600-VOLT CIRCUITS

lowered and removed from the cell, the contacts are left exposed for examination. This construction is also of great advantage when oil is to be changed in that the tanks can be moved on the truck to the oil room and the filling done there.

Some of the switches are equipped with series resistors in each phase, arranged in such a manner that when closing the switch the potential is first limited to its half value. This eliminates current rushes, which otherwise take place, as, for example, when switching in a transformer bank, before the magnetic circuit has had time to be normally saturated. For this reason oil switches with series resistors are to be recommended especially for low frequencies where transformers with a relatively high saturation have been selected. Such switches are also of great value for holding down the voltage when switching in long transmission lines or extensive cable systems. All the resistances are mounted inside the switches and for the largest sizes the arrangement is such that the resistance is connected in the circuit only during the time of operation while it is entirely disconnected from the circuit whether the switch is normally in the closed or the open position.

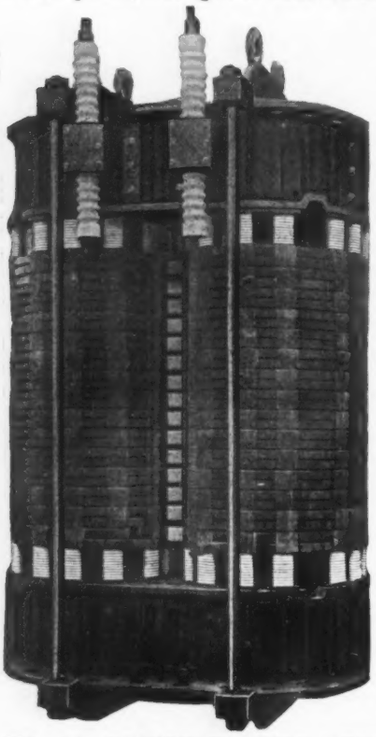


FIG. 14—TRANSFORMER WITH SHELL REMOVED

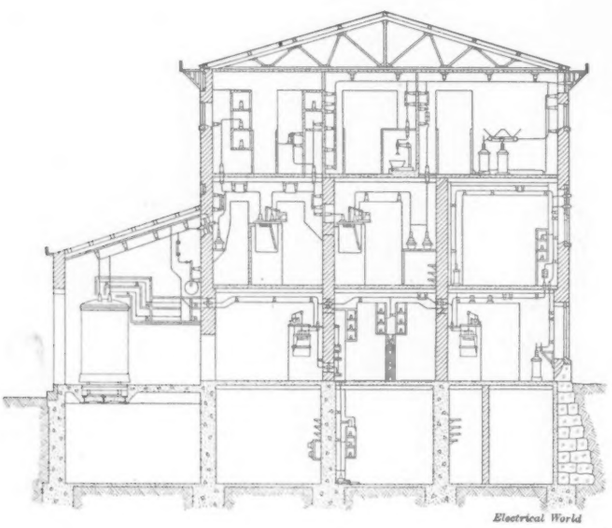


FIG. 15—SECTION AT SWITCH HOUSE

Transmission Lines

The outgoing 50,000-volt transmission lines consist of a 41-mile double-circuit line to the city of Gothenburg; a 20-mile branch line from the town of Lilla Edet, on this line, to the city of Alingsas, and a 45-mile double-circuit line from the power station at Trollhättan to the city of Skara, with a single circuit continuing for another 9 miles to the city of Sköfde. All the circuits are supported on steel towers of the flexible construction, approximately two strain towers being installed per mile.

The line to Gothenburg is of a very substantial construction, the tower to the left in Fig. 16 illustrating one of the strain towers for this line, while the flexible towers are of the A-frame construction. The normal span for this line is 600 ft., the six line conductors being of stranded copper of a size equivalent to No. 00 B. & S. The ground wire consists of a No. 0 steel cable supported on an upright extension of the towers. The strain towers have a normal height of 48 ft., weighing 6300 lb., while the flexible towers are 52 ft. high and weigh 3500 lb. each. The insulators on the strain towers are of the pin type and on the flexible towers of the suspension type. All the towers are provided with concrete foundations.

The lines between Trollhättan and the city of Skara and the line between Lilla Edet and the city of Alingsas employ a much lighter line construction. Both are of the double-circuit type, the span of the former being 550 ft. and that of the latter 600 ft. The conductors are equivalent to No. 2 B. & S. stranded copper cable and the ground wire consists of a No. 0 steel cable. The strain towers of both lines weigh 5000 lb. each and have a height of 48 ft. The flexible towers of the first line have a height of 47 ft., weighing 2200 lb., while for the second line they are 52 ft. high and weigh 2600 lb. Pin insulators have also been used on the strain towers and suspension insulators on the flexible towers on these lines. The design of a strain tower for these two lines is shown to the right in Fig. 16.

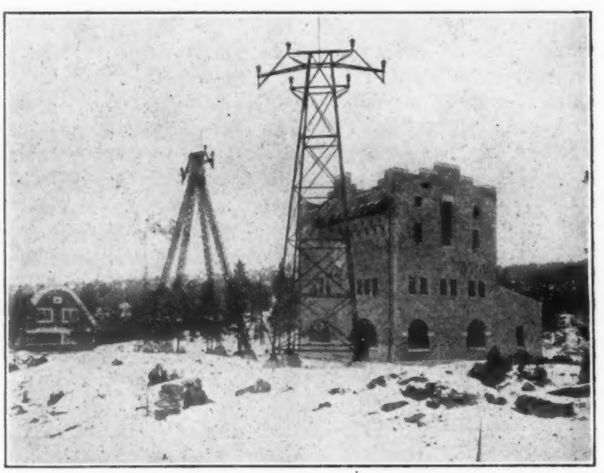


FIG. 16—TRANSMISSION LINES ENTERING SUBSTATION

The line between the cities of Skara and Sköfde is only single-circuit and the construction is very light. The normal span is 450 ft. and the conductors are of hard-drawn copper equivalent to No. 5 B. & S. and the steel ground wire is also equivalent to No. 5 B. & S. The strain towers for this line are 41 ft. high and weigh 2600 lb., while the flexible towers are 47 ft. high and weigh 1300 lb. The insulators are of the pin type. For all the 10,000-volt local distributing lines wood or steel poles with pin insulators are exclusively used.

The engineering and design in connection with this development have been done by the government engineers under the supervision of Mr. Torsten Holmgren, who is now the chief engineer and general manager of the plant. The electrical equipment, with a few exceptions, has been furnished by the Allmänna Svenska Elektriska Aktiebolaget (the General Swedish Electrical Company), of Westeras, Sweden.

The Planning of a Large Modern Steam Generating Station

During an address given at a joint meeting of engineering societies in Chicago on Dec. 23 Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, gave some interesting information about the considerations that influenced the location and design of the new Northwest station of the Commonwealth Edison Company, and also some facts about the equipment of this large and modern generating plant.

In determining the selection of a site for a modern steam generating station in a large city, the dominant factors are the ones involved in the economical handling and utilization of coal. The cost of the fuel exceeds all other operating costs combined, and as the consumption of fuel is in the ratio of two to three, depending upon whether the station is operating condensing or non-condensing, it appears that unless the coal consumption is to be increased 50 per cent the station must be located near an abundant supply of condensing water. This is the first specification for a steam power-station location.

If $1.70 a ton be assumed as the average price of steam coal in Chicago f.o.b. cars and it is further assumed that 60 cents a ton be the cost of cartage from the railroad to the power station, it appears that unless the cost of fuel is to be increased very materially, the generating plant must be located adjacent to a railroad, and preferably on a railroad which brings the coal to the city. Therefore, the determining factor of second importance is that of railroad facilities.

Desirable power-house sites are hard to find in a large city. When a satisfactory location is found it is advisable to provide for a large installation. At the time the Northwest station in Chicago was to have been started (that is, the winter of 1911-12) the maximum load on the system was about 200,000 kw, while the indication was that for a number of years the future increase would be at about the average rate of 15 per cent. Accordingly acreage sufficient to accommodate two generating stations of 120,000 kw each was sought, although it was not the intention to install machinery of this rating at the beginning.

Acreage Required for 240,000-kw Plant

The next step was to consider what acreage is required to accommodate a generating equipment of 240,000 kw. Experience has shown that such a power house supplying a diversified metropolitan load will at some seasons of the year be operated at a load-factor of 50 per cent. For a 240,000-kw installation this will require a daily coal supply of something over 4000 tons, or about 100 carloads. To make a moderate allowance for the uncertainties of freight traffic over a distance of 200 miles, provision should be made for storing on the property at least three days' supply of loaded cars and one day's output of empty cars, amounting altogether to 400 cars, and this will require 4 miles of storage tracks. Further, to protect its customers, an electric-service company should have on hand a reserve of at least ninety days' supply of coal. For the generating station or stations under consideration this would amount to about 350,000 tons.

The 240,000-kw station, or two 120,000-kw stations, together with storage tracks, storage coal piles and switch tracks, will require about 50 acres of ground, but after allowing for convenient spacing, parking and recreation grounds it will be found that the total space required for such a plant and all that goes with it is not less than 75 acres, the greater part of which is for receiving, storing and handling coal. Thus ample acreage is the third important factor in determining the location of the generating station under consideration.

The fourth consideration is a factor which in the earlier days of the electric-service industry was put first, and that is the nearness of the generating station to the center of the load.

Taking into account these four factors, Mr. Abbott exhibited a map to show why the site of the Northwest station on the North Branch of the Chicago River, in the neighborhood of California Avenue and Roscoe Street, was selected as the best that could be obtained. This site consists of one tract of 55 acres and another of 40 acres. These two tracts are separated by streets and dwelling houses, but are connected by the company's private elevated electric railway built on a right-of-way which was purchased. On the eastern side—the one bordering the river—it is planned to erect eventually two power stations. One of these is now partly built, the initial equipment of two 20,000-kw units being in operation. It may be remarked here that the Northwest station has been described in several articles published in the *Electrical World*, the latest being that by Prof. H. H. Norris in the issue of Oct. 5, 1912.

The speaker described the station, stating that about two-thirds of the first station has been completed, although only one-third of the equipment has been installed. He devoted considerable attention to the coal-handling equipment. If the incoming coal cars have drop bottoms, the unloading is done quickly by opening the drops. If a car does not have a drop bottom, it is unloaded at a cost of 2 cents a ton by a 2-yd. clamshell bucket operated from an overhead crane. In its passage through the boiler house the coal is handled on five different levers and in nine operations, but at no point is it necessary to use manual labor.

Two types of boilers are used at the Northwest station, one with a vertical pass for the hot gases and one with a horizontal gas pass. The purpose of using the two types is to give them a thorough test to determine which is the better, with the idea of insuring practically perfect, therefore practically smokeless, combustion.

Each boiler should be able to generate 30,000 lb. of steam an hour, and this will require a rate of coal burning of 4500 lb. an hour under each boiler. This means that in each second of time 300 cu. ft. of air passes through the grate. With sixty boilers, all running at the maximum rate, the amount of air entering the grates each minute would be over 1,000,000 cu. ft. To avoid unpleasant drafts of cold air in winter provision is made to admit air directly under the grates from the train-shed below.

The 20,000-kw vertical turbo-generators at the Northwest station are spaced 44 ft. apart, whereas the 12,000-kw units at Fisk Street are on 41-ft. centers. The steam turbines are six-stage machines and each one has 7392 buckets. The outside diameter of the sixth wheel is 13 ft. 2 in. and it has a peripheral velocity of over 500 ft. a second, or about 6 miles a minute. The guaranteed steam consumption, with steam at 250 lb. pressure and 100 deg. superheat, is 14 lb. per kw-hr. at loads of 10,000 kw and 20,000 kw, and 13.45 lb. at a load of 15,000 kw.

Comparison of Steam Turbines and Reciprocating Engines

Mr. Abbott devoted considerable time to an explanation of why the steam turbine is more efficient than reciprocating engines, and he gave curves showing a comparison of the expansions between steam cylinders and steam turbines from 175 lb. absolute pressure to 2.5 lb. absolute pressure. With the increased ratio of expansion which is obtained in the turbine the importance of low vacuums is much greater with the turbine than with the engine. Steam can be expanded from 200 lb. down to, say, 50 lb. pressure more economically in a steam cylinder than it can through the blades of the first stages of a turbine; but the loss through the low-pressure cylinder in the compound engine is so great that the combined efficiency of all the stages of the steam turbine is much better than is the combined efficiency of the two or more cylinders of a compound reciprocating engine.

In the 20,000-kw units at Northwest station the weight of the steam end of the turbine is 200 tons and of the generator 230 tons, making a total weight of 430 tons, of which 100 tons is in the revolving elements.

The generator mounted above the turbine is of the revolving-field type and generates 25-cycle, three-phase current at a pressure of 4500 volts, which is stepped up by transformers to 9000 volts. The revolving field has four poles and weighs 52 tons. The armature is star-wound and has a continuous rating of 2570 amp per phase.

Forced ventilation is used for the generator. Although the efficiency of the machine is high, yet because of the large amount of energy transformed the heat evolved by each generator is equal to that resulting from the perfect combustion each hour of 270 lb. of coal of the quality used in the boiler room.

At the Northwest station the additional reactance needed in the generator circuits to prevent surging is introduced by the auto-transformers, which raise the emf from the machine voltage of 4500 to the system voltage of 9000. These transformers are installed in a separate building.

In conclusion Mr. Abbott said: "The generating station just described is the most modern in existence and was designed by engineers who have been engaged all their lives in designing power houses and power-house equipment. No expense was spared to make this installation the last word in the art of converting the energy of coal into electrical energy. The station was designed for six units, two of which were to be included in the first installation and the remaining four to follow soon thereafter, so that the station when completed would contain a symmetrical, up-to-date equipment of the largest size and highest efficiency; but—alas for the best-laid plans!—between the time that the plans were finished and the completion of the initial equipment as great strides were made in the art as had been made during any period of equal length in its history. The Northwest station is doing all that was expected of it, but within a little more than a year from the time it was put into service its equipment will be eclipsed by an installation at Fisk Street of larger and more efficient boilers and larger and more efficient turbines. The indications now are that the equipment which will be installed at the Northwest station in the future will be of an entirely different type from that now in use there, and we may even hope that it will show as great an improvement over the newer Fisk Street turbines as those are expected to do over the machines we have discussed to-night."

Discussion

Mr. Bion J. Arnold spoke of the Northwest station as a great engineering achievement. Chicago has led in central-station design because of the broad conception exhibited in the management of its electric-service utilities, the engineering talent of the company and the ability of the consulting engineers. Mr. Arnold referred to the increase in thermal efficiency of power stations, which he said had now reached about 10 per cent in the case of modern 10,000-kw units. In one New York station with reciprocating engines and low-pressure exhaust-steam turbines this figure has reached something over 11 per cent, and very likely the Northwest station will do as well. Another feature of the Northwest station praised by Mr. Arnold is its simplicity. The speaker made the interesting statement that the New York Edison Company is now contemplating taking over one or both of the generating stations of the New York Central Railroad used for supplying electricity to its New York City terminal, the arrangement being that the railroad company shall buy its electrical energy from the electric-service company, the latter operating the existing generating stations of the railroad company.

Mr. G. T. Seely, assistant general manager of the Chicago Elevated Railways, commented on the fact that the protected third-rail used in the Commonwealth Edison Company's private elevated railway is the only contact rail of that type of which use is made in this part of the country.

One gentleman asked what precautions had been taken to protect the very large storage piles of coal from spontaneous combustion. Mr. Abbott said that he knew of nothing that would absolutely prevent all danger of spontaneous combustion of coal in large storage piles unless it be the use of coal in large sizes. Screenings in large piles are almost sure to take fire in warm weather, and this is a contingency that must be anticipated and guarded against.

Demagnetization and Recovery of Permanent Magnets

By Shiro Sano

It is a well-known fact that a permanent magnet loses considerable of its attractive force when it receives a mechanical blow. However, it is not quite so well known that the magnet may recover its magnetic force, fully or partly at least, according to its magnetic conditions, when it is given a certain mechanical treatment.

The writer has performed a series of experiments with a view to ascertaining more or less quantitatively the effect of mechanical mistreatment upon the demagnetization of a

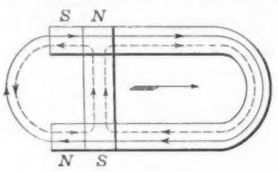


FIG. 1—FLUX DISTRIBUTION IN HORSESHOE MAGNET

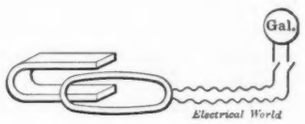


FIG. 2—ARRANGEMENT FOR MEASURING MAGNETIC FLUX

permanent magnet and its recovery therefrom. A standard form of a horseshoe magnet, such as is used in the ordinary telephone signaling generator, was taken as the sample for experimentation. It was about 5 in. long, ¾ in. wide, ⅜ in. thick, and the two legs were separated by 1¾ in. and had a soft-iron armature or keeper 2.5 in. long, ¾ in. wide and ⅛ in. thick.

The first experiment consisted in measuring the effect upon the magnetic force of the magnet of rubbing the armature on the surface of the magnet in the direction of the arrow-head, as shown in Fig. 1. This experiment was performed in order to ascertain the effect produced in constructing the magnet generator where the magnets usually are magnetized first and then inserted in their place, during which process they are, incidentally, rubbed upon by the pole-pieces of the generator.

TABLE I—RESULTS OF TEST ON PERMANENT MAGNET

Number of Strokes	Galvanometer Throw	Per Cent Throw	Total Number of Strokes
0	64	100	0
1	48	75	1
1	40	62.5	2
1	39	60.9	3
4	35.5	55.5	7
6	34	53.1	13
10	33.5	52.3	23
10	33	51.6	33
30	32.5	50.8	63

In order to measure the magnetic force of the magnet the apparatus shown in Fig. 2 was used. This consists of a coil made up of a bundle of fine wires inserted inside the horseshoe magnet. The two terminals of the coil are connected through a switch to a ballistic galvanometer. A quick withdrawal of the coil from inside the magnet will produce a throw on the ballistic galvanometer, thus giving a measure of the flux cut by the motion of the coil. The

throw of the galvanometer will, therefore, represent the magnetic force of the magnet. At first sight this may seem rather a crude way of measuring the flux, but experience shows that it is more reliable than it appears. The throw of the galvanometer was first measured with the magnet magnetized initially by a powerful magnetomotive force. The results of the first experiment are given in Table I.

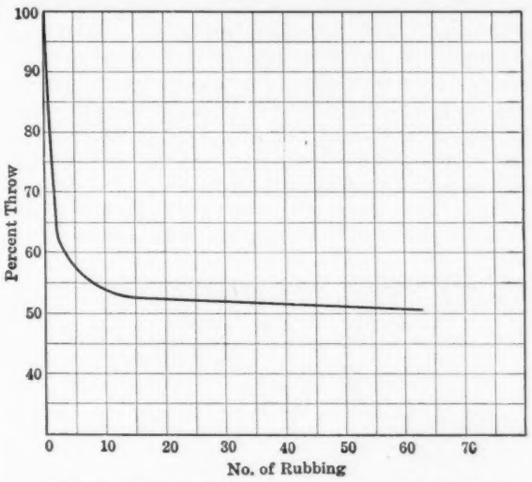


FIG. 3—CURVE SHOWING RESULTS OF TABLE I

By this table it is seen that the strength of the magnet is considerably lowered by rubbing it with the armature when the degree of magnetization is high, while it is not affected so much when the degree of magnetization is already lowered. Thus, in the first stroke, the magnetic force was lowered approximately 25 per cent, while from the thirty-third to the sixty-third stroke the percentage throw of the galvanometer decreases only from 51.6 to 50.8, a comparatively small amount.

The second experiment consisted in sliding the keeper upon the side of the magnet first in one direction and then in the opposite direction. The magnet was first subjected to the action of a very powerful mmf about 20,000 ampere-turns being applied to the whole magnetic circuit. The throw of the galvanometer was noted before any rubbing was done and after each positive and negative stroke. By positive stroke is meant the sliding of the keeper in the

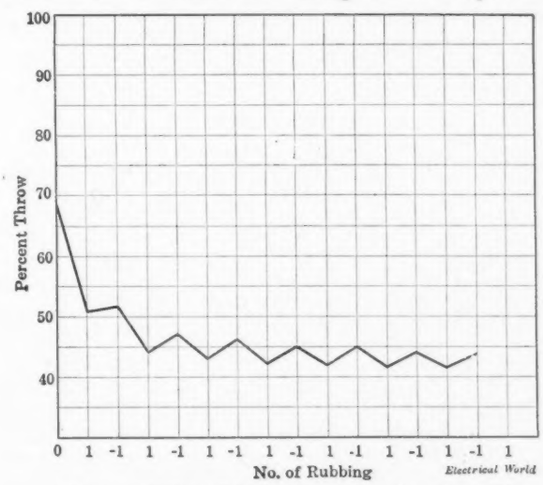


FIG. 4—CURVE SHOWING RESULTS OF TABLE II

direction shown by the arrow-head and by the negative in the opposite direction. The results are seen in Table II.

It will be noted that the first positive stroke decreased the throw of the galvanometer from 68 to 50.5, and the next negative stroke increased it to 51.5; that is, the negative stroke restored a very small amount of the magnetic force. From the sixth reading on, however, the recovery of magnetic force due to negative rubbing was well-nigh complete.

To account for these phenomena the writer offers the following explanation: With the keeper in the position shown in Fig. 1, a pole of opposite polarity would be set up at each end. If we consider the keeper as an independent magnet, then the flux produced by it will be set up as shown in the dotted lines, whereas the main flux is directed as shown in full line. Evidently, toward the open end of the magnet the two fluxes are opposed to each other, while toward the closed end they assist each other. If, now, the keeper be moved in the direction shown, the oppositely directed fluxes produced by the keeper will extend gradually over all the magnet and will result in weakening it. If, on the other hand, the keeper be moved in the opposite direction, away from the closed end, the local flux, directed in the same sense as the main flux, will gradually extend over the whole length, while the oppositely directed flux will be eliminated.

The reason the demagnetization is so severe when the magnet is highly magnetized and rather feeble when the magnet has been demagnetized is because in the first case

TABLE II—RESULTS OF RESTORATIVE TEST

	NUMBER OF STROKE														
	0	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1
Galvanometer throw....	68	50.5	51.5	44	47	43	46	42	45	42	45	41.5	44	41.5	44

the magnet is well saturated, and consequently a little decrease in flux will have a correspondingly great decrease in magnetizing force, while in the second case the magnet is not saturated, and hence a decrease in flux will cause a proportional decrease in the strength of the magnet. The answer to the question as to why the recovery of magnetic force is slight when the magnet is near saturation seems to be that a little decrease in flux by positive rubbing will correspond to a large decrease in strength, and when the magnetic force is enfeebled once for all, the negative rubbing, however repeated, cannot force the flux to return to a value near saturation.

Fuel-Oil Engines

At the recent annual meeting of the American Society of Agricultural Engineers in Chicago, Prof. C. F. Hirshfeld, of Cornell University, delivered a scholarly address on "The Principles of Fuel-Oil Engines." Beginning with the fundamentals of vaporization, the speaker summarized the chemistry of fuel combustion in oil engines. He surveyed the latest researches in this rather complicated subject and as a practical conclusion laid great stress on the importance of fine spraying in any fuel-oil engine. This fine spraying may bring difficulties of its own in its train, and Prof. Hirshfeld devoted considerable time to a consideration of the use of water vapor as a corrective, particularly in the case of kerosene engines. The peculiar phenomena observed upon mixing kerosene and water in internal-combustion engines were discussed at some length. One interesting observation made was that the Diesel engine is nothing but an internal-retort engine working without water. The speaker thinks there is no question that the Diesel engine is the most nearly perfect type of oil engine in existence.

Mr. John A. Secor, of the M. Rumely Company, discussed the paper. He spoke of the growing scarcity of gasoline as a fuel for internal-combustion engines. Fortunately, however, kerosene is available, and in many respects it is an ideal fuel. Mr. Secor thought the Diesel engine unreliable, at least for agricultural work.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Electricity for Farms in the Blue Grass

The farm as a user of central-station energy is being uncovered by the Kentucky Utilities Company, of Lexington, which operates in a large part of the Blue Grass section of the State. It has secured franchises for stringing its wires in a number of counties adjoining Fayette, which contains Lexington, and is preparing to go after farm business in earnest. Not only is the company securing contracts for lighting residences and barns but it is also wiring farm property so as to enable agricultural machinery, of which the modern farm has a large array, to be operated electrically. A number of farmers had already bought gasoline engines with which to generate power for their corn shredders, feed choppers and the other equipment in their barns, and the opportunity to substitute the more satisfactory, convenient and economical service of the central station is being embraced with enthusiasm. Among the large estates which have contracted with the Kentucky Utilities Company for service for the purposes indicated is that of Clarence Lebus, president of the Burley Tobacco Society and one of the leading figures in Kentucky agriculture.

Reduction of Rates in St. Louis

Following its reduction of rates effective on Dec. 1, 1912, the Union Electric Light & Power Company of St. Louis sent a circular letter to its commercial customers asking them to fill out an inclosed card if they wished to take advantage of the new commercial rate schedule provided that the net rate accruing thereunder was not higher than under the existing contract. During the month of December about 7000 responses were received. In about 90 per cent of the cases so far reported the consumer has been materially benefited by the new rates. The matter has been handled in this way because there are several different schedules, and the customer's consumption is taken for a year and figured on the basis of the various schedules to ascertain which is the most beneficial to him. The company announces that it will continue its policy of rate reductions from time to time as conditions warrant, and patrons will always have the benefit of these reductions regardless of existing agreements.

Stimulating Popular Interest in Ornamental Lighting

Since the Bay City (Tex.) central station was acquired by the Emanuel syndicate of Dayton, Ohio, several months ago, efforts have been directed toward improving the local standard of street illumination. To this end the local manager, Mr. W. C. Duncan, recently succeeded in getting the Business Men's League of Bay City to hold a banquet to boost the installation of a new system of ornamental tungsten-post lighting. In the banquet room, as the accompanying illustration shows, the central-station company erected one of the five-lamp standards which it proposed to install in the downtown section, and this actual demonstration created the greatest interest among the leading citizens of the community who were present at the meeting. Enthusiastic speeches were made, and the next evening the City Council took the matter up for discussion.

Later the Bay City company scored another popular hit by transferring this sample post from the banquet room to the interior of the post office. This building is owned by a man who rented the room to the government seven years ago, when rents were low, on a ten-year lease, to be heated, lighted and kept in repairs for the sum of $200 per year. Buildings are now renting on each side of the post

BANQUET ARRANGED TO STIMULATE ORNAMENTAL LIGHTING

office for $50 to $60 a month. Consequently the owner does not feel like spending more money in improvements. The public as a whole was suffering, as it was almost impossible to see the combination on one's lock box by the aid of the two 2-cp lamps which were depended upon for lighting the space, 25 ft. by 80 ft. The sample post lamps now furnish a degree of illumination over the entire lock-box area that is brilliant by comparison with the former conditions, and this public-spirited movement of the utility company has occasioned some very complimentary comments from the townspeople.

Liability of Superintendent for Death of Inexperienced Lineman

A lawsuit that is attracting some attention among electrical men was tried in the Circuit Court at Peoria, Ill., last month. The action was brought by John Zaitz, as administrator of Edward Zaitz, against Frank Z. Ames. It grew out of the death of Edward Zaitz while employed as a lineman by the Minonk Electric Light & Power Company, of Minonk, Ill., of which Mr. Ames, the defendant, was superintendent at the time of the accident. It was asserted on the part of the plaintiff that Zaitz was young and inexperienced and knew nothing of the danger of working on the line, which carried wires charged with a voltage dangerous to human life. As superintendent of the company, it was alleged that Mr. Ames ordered young Zaitz to ascend a pole and do some repair work in proximity to the high-potential wires. Further, the plaintiff declared, Ames knew of the danger and did not inform Zaitz. In neglecting to do so it was charged that the superintendent was guilty of negligence and carelessness, and that by reason thereof Zaitz, while doing the work he was directed

to do, came in contact with the primary wires of the overhead circuit, which was carrying a current having an emf of over 2000 volts, and was killed. The administrator sued for damages to the amount of $10,000.

On the part of the defendant it was contended that Zaitz had been told by the construction superintendent a few days before the accident of the danger of coming in contact with the primary wires. Evidence was given to show that at the time when the accident happened Zaitz had climbed the pole of his own motion, although another lineman had started to do the work. The work to be done was merely the attaching of some secondary wires to brackets 18 in. or 20 in. below the primary wires. After the young man had attached one wire to a bracket on one side of the pole he shifted his position to the other side, waiting, apparently, until another secondary wire should be passed up to him. While waiting he apparently raised his hands and heedlessly placed them in contact with the primary wires over his head. He was seen immediately after the shock with his hands extended above him and swinging back, hanging by his belt and spurs.

Notwithstanding the evidence introduced by the defense, the jury found a verdict for the plaintiff, allowing the administrator $2,000 for the benefit of the next of kin of the decedent. No immediate judgment was entered on the verdict. A motion for new trial has been filed, and if it is not allowed the case will be taken to the Appellate Court. The case was hotly contested, Weil & Bartley appearing for the plaintiff, and Winslow Evans for the defendant.

Making a Central-Station Sales Agent of the Contractor

A simple co-operative plan has recently been developed by the Edison Electric Illuminating Company of Brooklyn through which it has added more than thirty of the electrical contractors in that city to its selling force without incurring any appreciable expense for their services.

The salient features of the plan are that the company acquires from the contractor the privilege to paint the words

FIG. 1—STORE OF HEBREW CONTRACTOR ACTING AS CENTRAL-STATION AGENT

"Edison Light, Heat and Power Applications Received" upon the contractor's window as shown in the accompanying illustrations, explains its contracts to the contractor, authorizes him to take applications for its service and renders him any and all assistance he desires in getting new customers for it. Applications for practically all classes of service may be taken by the contractor. In exceptional cases, involving contracts for extensive motor-service or lighting requirements, the company's representatives give the prospective customer such information as the contractor is unable to furnish, or conduct all negotiations if desirable, upon receipt of a notice from the contractor.

In return for this privilege, which also results in increased installation for the contractor, the company fur-

FIG. 2—ATTRACTIVE DISPLAY IN CONTRACTOR'S SHOW WINDOWS

nishes window lighting for the contractor from dusk to midnight without charge, the turning on and off of the supply being done at an outside switch by the company.

In this way the company has secured a number of desirable branch offices in several of the important business sections of the city. The plan has been so successful that it will be extended within a short time so that similar branches will be available in all parts of the city. Only financially responsible and progressive contractors are made parties to this plan. The only other conditions imposed by the company are that the contractor install an attractive plate-glass front if one is not already in place and remove all references to any other lines of business he may carry on.

The lettering is plainly visible both day and night and presents an excellent advertisement of the company's business to pedestrians and passengers in surface cars.

The Brooklyn company is planning to install in the windows of contractors acting as its agents attractive displays of apparatus that is sold and installed by the latter, the idea being to render all the assistance in its power to make the windows attractive and ultimately to increase its revenues from the sale of energy. These displays will be changed periodically, probably once a month.

Central-Station Service for Louisville Newspapers

The efficacy and economy of central-station service has been again demonstrated in the case of the Louisville *Courier-Journal* and the Louisville *Times*, Colonel Henry Watterson's famous newspapers, which have moved into a handsome new home at Third and Green Streets in the Kentucky city. They formerly occupied space in a large building at Fourth and Green Streets, using for lighting and motors electricity produced by their own generators. When the matter of equipping the new building came up, however, it was decided to depend chiefly on central-station service, retaining the connections with the plant in the old building, which is still in commission, for emergency purposes only. The Kentucky Electric Company was given the contract and is supplying all of the energy.

Electric Mine Pumps Pay Own Cost in Fifteen Months

Mine-water trouble at the Vindicator and Golden Cycle shafts, on the east side of the Cripple Creek (Col.) mining district, has now been overcome by the installation of electric pumps in the latter shaft. The water is lifted to the 100-ft. level, and then flows through the Cycle into Wilson Creek, at a reduced cost compared with that of steam pumps. The electric pumps consist of two sets of 175-hp, 30-cycle, 2300-volt motors, driving triplex pumps at the 1000-ft. level, each pump lifting 400 gal. per minute. The motors are of the two-speed type. On a twenty-four-hour basis the units will have an 85 per cent load-factor. It is expected that the new pumps will pay their cost in fifteen months. The pumps are installed 1600 ft. underground and are running without any trouble. Recently they were covered with 150 ft. of water, owing to a faulty connection in the discharge pipe. A test gave an over-all efficiency for these pumps of 83.8 per cent, comparing the electric input at the surface with the water discharged at the surface. On the showing made by these pumps it is expected that additional drainage in the Cripple Creek district will be done by electrical energy.

Prompt-Service Methods in Minneapolis

In order to facilitate prompt-service connections the Minneapolis General Electric Company has prepared a reply postal card which is handed or mailed to each new customer when the contract is made. The portion of the card addressed to the customer bears the following message:

"Your application for electric service has been received. We desire to connect service and meter for you as quickly as possible. Before the meter can be installed it is necessary that your wiring and fixture contractors obtain an inspection of the wiring and fixtures from the city building inspector's department. Switches and cabinet boxes should be completed to secure their approval. Service wires are extended to the premises at our expense. If service is not given promptly after the above requirements are complied with, please detach and mail the attached card to the company, and it will receive immediate attention."

The card addressed to the company contains the following: "Premises No. —— are ready for your service, having been properly inspected and accepted. We should like to have your service installed by next —— night. If house is not open, key can be found at No. ——. Yours truly, ——."

Development of a Modern Central-Station Generating Plant

In 1902, when the Ashley Street generating station in St. Louis was designed and partly built, the plant was planned for a total output of 12,000 kw in reciprocating-steam-engine-driven units. This equipment took up about two-thirds of the engine-room space provided, and there was one deck of twenty-eight Scotch marine boilers. Before the station was entirely completed, the company owning it was reorganized, and the property was purchased by the Union Electric Light & Power Company, its present owner. The remaining one-third of the engine-room floor area was utilized for the installation of four 5000-kw vertical turbo-generators, this row of machines taking up an area about 72 ft. in length over all and about 36 ft. wide.

With the advancement of the art, the 5000-kw units came to be regarded as uneconomical and practically obsolete in a very few years. They were removed and 12,000-kw units were installed in their place; that is to say, the steam rotors and the electrical generators were replaced, the foundations and all auxiliaries remaining unchanged. In 1904 two 2000-kw vertical units were installed. These were later replaced by two 4000-kw horizontal units. The auxiliaries and condensers for these smaller units were also used in the installation of the larger units.

Mr. John Hunter, chief engineer of power plants for the Union Electric Light & Power Company, who has been in charge of the work during this interesting transition period, is of the opinion that the installation of turbo-generator units represents the greatest amount of power developed anywhere in an engine-room area of equal size.

The maximum rating of the Ashley Street station is now about 70,000 kw, and the maximum load carried is about 55,000 kw.

To meet the demand for additional steam-raising equipment, it was necessary to install a second deck of boilers. The newer boilers are of the water-tube type, of 500 hp normal rating each, with over-load rating of 75 per cent. Later the marine boilers were removed to make room for more water-tube boilers, as the load on the station increased. The plant is so designed that reserve coal is carried in overhead bunkers to the extent of a ten-day supply. Coal is raised to these bunkers by tower hoists with a lift of 132 ft. This plant has a unique distinction in the fact that delivery of all coal from the bunkers and the collection of ashes in the basement is done by gravity. The ashes are raised by small cars to the top of the building, where large bins are provided. Storage capacity is provided for ashes to the amount of about ten carloads.

Miniature "White-Way" Lighting in Central-Station Window

In connection with the recent inauguration of an extensive installation of "white-way" lighting at Lynn, Mass., the Lynn Gas & Electric Company equipped its main display window with ten miniature 110-volt inclosed-arc lamps mounted on miniature ornamental standards, the lamps being placed against an attractively painted background of a parkway scene. A number of electric heating devices were shown at the front of the window, and a display of the national colors completed the effect. The miniature lamps were operated first on the same night that the city's full-size display was placed in service, and the window attracted much local comment. Incidentally, a temperance campaign was in full swing during the period in which the ornamental lighting was started, and effective use of an electric sign was made by the anti-saloon interests in one of the most important squares of the city. The sign carried the "slogan" "Make it six," thus advising the passing voter to add another "dry" year to the five preceding the election.

Static Due to Feather Duster Cause of Filament Breakage

In a certain Eastern school building complaint was made about the short life of the incandescent lamps furnished, many globes being found with their filaments broken and twisted to the sides of the glass. The lamps themselves, when tested in regular life racks, showed good average performances, so that a service test was finally determined upon for the purpose of studying the lamps under actual working conditions.

In twenty-six days, according to the New York Electrical Testing Laboratories, fifty-six lamps, or 29 per cent of the total, burned out. Thirteen new lamps were then put in one of the fixtures, and after being dusted in the regular manner with a feather duster, current was turned on and four of the lamps immediately burned out. Wiping with a slightly dampened cloth was substituted for the cleaning with the feather duster, and the abnormal breakage at once ceased.

Wiring and Illumination

Grounding Secondaries in Rocky Mountain Districts

A controversy concerning the effectiveness of methods proposed is delaying the grounding of secondaries in Pueblo, Col. The usual Byllesby method, employing driven pipes, is opposed by Mr. W. J. Canada, the engineer of the Rocky Mountain Fire Underwriters' Association, as being unreliable when used in dry soils for the protection of secondaries fed from heavily fused primaries. The Underwriters' Association is recommending water-main grounds, and these have been generally adopted in the Rocky Mountain district.

Wood Poles in the Electrical Industry

The accompanying figures, showing the extent and classification of the wooden poles purchased in the electrical industry from 1907 to 1911, are taken from the report issued by the Bureau of the Census, which was prepared with the co-operation of the Forest Service. The compilation was made by Mr. J. E. Welchel, under the direction of Mr. W. M. Steuart, chief statistician for manufactures.

The total purchase of poles in 1911 was less than for 1910 and 1909 by 452,674 and 320,720 respectively, but exceeded the totals for 1908 and 1907 by 168,866 and 134,752 respectively. The decrease was confined to a falling off in purchases by telephone and telegraph companies and steam railroads, while a substantial increase in purchases was made by electric railroads and electric light and power companies. The decrease reported by the telephone and telegraph companies was not general, being confined in the main to states in which there was more than usual activity in the construction of lines during 1910. The increasing use of concrete and steel poles and towers also has a bearing on the demand for wooden poles, whose use they now restrict materially.

NUMBER AND KIND OF POLES PURCHASED IN THE ELECTRICAL INDUSTRY, 1907 TO 1911

	1911	1910	1909	1908	1907
Cedar	2,100,144	2,431,567	2,439,825	2,200,139	2,109,477
Chestnut	693,498	677,517	608,066	516,049	630,282
Oak	199,590	265,290	236,842	160,702	76,450
Pine	161,690	184,677	179,586	116,749	155,960
Cypress	72,995	75,459	77,677	90,579	100,368
Juniper	27,847	20,042	43,581	42,367	38,925
Redwood	26,887	30,421	23,145	13,061	31,469
Douglas fir	24,833	56,732	24,877	19,542	15,919
Tamarack	23,543	30,964	29,889	24,123	13,884
Osage orange	21,101	23,221	21,491	18,109	5,962
Spruce	10,166	22,929	11,423	8,088	10,646
Locust	8,477	9,030	10,463	10,224	4,672
All other	47,258	42,845	31,875	29,422	89,254
Total	3,418,020	3,870,694	3,738,740	3,249,154	3,283,268

Of the total reported purchases in 1911, 2,402,724, or 70.3 per cent, were made by the telephone and telegraph companies; 787,649, or 23.0 per cent, by the electric railroad and central-station companies, and 227,647, or 6.7 per cent, by the steam railroads.

During the five-year period covered by the report the total purchase of poles was 17,559,876, of which cedar contributed 11,281,152, or 64.2 per cent; chestnut, 3,125,403, or 17.8 per cent; oak, 938,874, or 5.3 per cent; pine, 798,662, or 4.5 per cent, and cypress, 417,087, or 2.4 per cent. While these five varieties have during each of the five years covered furnished 94.3 per cent of the total, the tendency is now to substitute less expensive woods. With a decrease in the number of poles reported from all woods in 1911 as compared with 1910 of only 11.7 per cent, the loss in cedar was 13.6 per cent, in oak 24.8 per cent, in pine 12.4 per cent, and in cypress 3.3 per cent. A slight gain was made by chestnut, of 2.4 per cent. In all, thirty-five different species of timber contributed to the total pole purchases in 1911.

In 1911 656,504 poles were reported as having had some kind of preservative treatment. This number exceeded the total for 1907 by 260,305, that for 1908 by 312,116, and that for 1909 by 79,873, but was less than the number reported as having been treated in 1910 by 168,169. The principal woods treated in 1911 were cedar, yellow pine and chestnut.

"White-Way" Lighting at Lynn, Mass.

An extensive installation of "white-way" magnetite-arc lighting was inaugurated at Lynn, Mass., on Dec. 9, the occasion being marked by an automobile parade and a celebration in which local public officials and commercial organizations took part. Elaborate decorations were installed throughout the business district, and many visitors from other parts of New England were present to witness the transformation of the downtown streets, for it is declared that no city in the world possesses public illumination equaling that of the Lynn business district. The lamps were switched on after a prearranged period of about three hours' darkness, and it is estimated that upward of 60,000 people were on the streets when the circuits were closed.

FIG. 1—MARKET STREET, LYNN, MASS.

The Lynn installation is of particular interest because it includes both main and side streets and because of the exhaustive study given to local conditions by the manufacturers' designing engineer, Mr. C. A. B. Halvorson, Jr., under whose direction the lamps were located with the special object of providing uniform illumination throughout the business district. Contrary to common practice in "white-way" lighting, the Lynn installation is being operated as a part of the regular city street lighting. The city pays at the rate of $70 per lamp per year for service until midnight, and $82.40 per lamp-year where all-night service is maintained. Energy for the operation of the system is supplied by the Lynn Gas & Electric Company. The lighting equipment itself was purchased and presented to the city by the local Board of Trade and retailers' association, the merchants having been assessed $2 per front foot to meet this installation cost.

At present the installation comprises 152 6.6-amp direct-current General Electric luminous-arc lamps mounted on specially designed columns and equipped with medium alabaster globes. The lamps consume about 515 watts each at the arc and in general design are similar to the well-known New Haven units described in the *Electrical World* of Dec. 23, 1911, page 1525. An improvement, however, introduced since the latter pioneer installation was completed, is the redesign of the working mechanism to make it fit into a compartment 3 in. smaller in diameter, thus enabling the lines of the pole and its surmounting equipment to be

made more attractive from the artistic standpoint. The standard posts carry the arcs 14.5 ft. above the street. In one or two instances, however, the importance of adequate distribution in a public square led to the installation of the units in pairs, with the arcs elevated 28 ft. above the street. The poles were built by the Lundin Electric & Machine Company, of Boston, Mass., and were designed for this installation by Prof. E. J. A. Duquesne, of Harvard University, chairman of the art commission of the Republic of France.

FIG. 2—CITY HALL SQUARE

The standards are in general mounted upon concrete foundations 3 ft. deep, 2 ft. square at the top and 3 ft. square at the bottom. Four ¾-in. anchor bolts are used to secure each post. The spacing varies from 70 ft. to 250 ft., the lamps usually being staggered on opposite sides of the thoroughfare, so that the interval between units along the street is virtually halved when taking the street as a whole into account. About 50,000 ft. of No. 6 B. & S. cable was installed in connection with the underground feeds. The arcs are operated in two circuits from 75-lamp, double-tube rectifiers located at the generating plant of the Lynn Gas & Electric Company and supplied with energy from the 2300-volt buses of the station through constant-current transformers. Each standard is equipped with a Lundin positive cut-out switch of the series type, which short-circuits the lamp and also cuts its mechanism dead from the external lines when thrown by hand. The top of the post fixture is about 16 ft. 8 in. above the street.

FIG. 3—ORNAMENTAL POST NEAR PUBLIC LIBRARY

The Lynn installation extends in general from City Hall Square throughout the district lying between Broad Street, Market Street and Central Avenue. There is also a notable illumination of cross streets and prominent thoroughfares leading from Central Square, which is occupied by the principal steam railroad and trolley facilities reaching the city. The accompanying illustration of the lighting of Monroe Street (Fig. 4) typifies the scope of the cross thoroughfare illumination adopted. This street is about 30 ft. wide, and the lamps are spaced 130 ft. apart in the region shown, or 65 ft. apart considering both sides of the roadway. In a length of 600 ft. there are eleven lamps. On Market Street, the principal business thoroughfare of the city, there are thirty-seven lamps in a total length of 1700 ft. Here the width of the roadway varies from about 40 ft. to 100 ft. On the four cross streets between Central Square, Liberty Square and City Hall Square thirty-three lamps are installed. All-night lighting is provided for these sections as well as for portions of the main thoroughfares. A number of lamps on ornamental posts have also been placed in the parkways of the city, and the residential district will shortly be equipped with improved lighting facilities. As yet no photometric measurements have been made on the streets, but the designers planned to obtain an average illumination of at least 3 ft.-candles throughout the territory covered by the "white-way" installation.

FIG. 4—MONROE STREET, A CROSS-TOWN THOROUGHFARE

American and European Wiring Practice

By A. H. Bernhard

The writer of the present article has had about eight years' experience in electrical contracting work in Europe, mainly on the French and Italian Riviera, and thinks that consulting and operating engineers as well as wiring contractors may be able to find some European methods worth adopting and incorporating in the wiring practice of this country.

The first striking difference between American and European—especially French—practice is that concealed wiring is quite rare outside of the United States. There are three reasons for this—the customer has been educated to seek a very cheap installation, he rarely considers wiring a house before it is entirely completed, and, as the "furred" construction of buildings is unknown in France, it is necessary to channel the brick or stone walls and the hollow tile partitions for all concealed conduit work.

In order to give a clear insight into French wiring practice, the several systems of wiring used in France will be described, beginning with the system most used, which is unquestionably the flexible-cord system.

Flexible-Cord System

In an apartment house installation, for instance, the rooms are wired by the flexible-cord system in about the following manner: In the center of the ceiling of each room a rosette with counterweight cord adjuster is placed, and a flexible cord is run along the ceiling from the rosette to one of the walls of the room, and then down the wall to a conveniently placed snap switch containing an open fuse-wire cut-out.

The flexible cord generally used for circuits of this kind, feeding not more than three or four 50-watt lamps, is a two-conductor twisted cord, each conductor being equivalent to a copper wire having a diameter of 0.9 mm (No. 18 wire). In order to make this cord very cheaply and at the same time small in diameter and flexible, so as to negotiate the pulleys of the counterweight adjuster, the insulation is generally composed as follows: one serving of cotton yarn, two thin unvulcanized Para rubber tapes wound in reverse directions, another serving of cotton yarn, and finally a braid of either mercerized cotton or linen or silk, these braids being furnished in innumerable standard colors and art shades, so as to harmonize with the tints of the wall paper or other room decorations.

The twisted flexible cords are slipped over small porcelain wiring knobs placed every three or four feet. A thin, round varnished wooden block is often placed between the rosette and the ceiling and between the snap switch and the wall, so as to avoid direct contact of the flexible cord with those surfaces.

From the snap switch a similar flexible cord is run up the wall toward the ceiling and out through a hole in the partition into the hall, where it is tapped into either a flexible cord main or a main composed of rubber-covered wire run in wooden molding.

As will be evident, the main idea is low cost. And it must certainly be a surprise to engineers accustomed to the rigid requirements of the National Electrical Code to know that these cheap jobs really give very little trouble. In fact, the writer has never known an actual fire to be started by a short-circuit caused by this seemingly unsafe type of wiring.

It will be noted that practically every lamp so installed is a drop lamp, and by far the greater part of these are equipped with the very convenient counterweight type of cord adjuster, which allows the lamp to be used at any height and at any lateral displacement in the room. For instance, in the case of bedrooms, reading in bed is easily provided for by driving a nail into the wall over the head of the bed and hooking the lamp-cord on it. Such a scheme is considered hazardous in this country, but not in the European countries under consideration.

Snap Switches

Another point to be noted is that almost every lamp is controlled by a snap switch placed on the wall of the room beside the door, so as to be convenient on entering. This is not true of the majority of the installations which are made in the United States.

Most snap switches of European make are "junk" compared to those of American make, and, furthermore, the writer has always found that the practice of using open-wire fuses in snap switches is very troublesome as well as unsatisfactory, the American system of centralizing cut-outs on panels and using only one fuse for each 660 watts of connected lamps being, in his opinion, a much better one from every point of view.

Bayonet Sockets

The writer also knows of no more diabolical invention in the electrical line than the "bayonet-catch" socket, which is used almost exclusively in France and England and to a much less extent in other European countries. This type of socket and lamp base has just two advantages—very low first-cost and ease of snapping the lamp in and out of the socket by a quarter-turn of the lamp bulb. In all other respects the American screw base is far superior, and it is preferred in Germany, Italy and other European countries outside of British and French influence. The writer has seen so many short-circuits, shocks and fallen lamps and reflectors, due to the use of the bayonet-catch socket, that he is convinced of the grave defects of this construction.

Cost of System

It might be stated that a fair average price for flexible-cord work in France is about 15 francs ($3) a lamp (one lamp to a room), each lamp being installed as above described, mains being run either in flexible cord or in molding, including meter-board, main cut-out for open fuses, all wiring, snap switches, rosettes, counterweight cord adjusters, bayonet-catch sockets, flat, opal or enameled-iron reflectors and carbon-filament lamps. The price given is for jobs of from six to ten lamps, using a fair quality of French material. On larger jobs even lower prices can be obtained.

Of course, the substitution of American sockets and switches for those of French make and the use of prismatic-glass shades and tungsten lamps would change the cost considerably, but it still would remain much below the cost of any other system of wiring.

Armored Cable Versus Conduit Systems

Conduit systems have long occupied an almost exclusive field whenever overhead lines were to be placed underground, no other underground method being available. Armored cable, however, is beginning to get a foothold, not as a direct substitute for the conduit system but rather in a field of its own which covers one particular phase of underground systems. This field includes the smaller cities, suburban districts, parks, private residences and manufacturing plants where the buildings are spread over a considerable area. The tungsten lamps in the New York City parks, for instance, are fed with energy through armored cable laid in the ground. Installations of this sort where the service rendered is comparatively small do not warrant a large expenditure to increase the fixed charges. The following figures recently submitted by the Simplex Electrical Company of Boston show the cost of the lead-covered cable in ducts and also of the armored cable laid directly in the ground:

COST OF LEAD-COVERED CABLE LAID IN DUCTS

1000 ft. No. 6 three-conductor, rubber insulated, lead-covered cable (600-volt service)	$175
1000 ft. conduit	55
Cost of laying, including cost of two manholes and drawing in and splicing cable	450
	$680

COST OF STEEL-TAPED CABLE LAID IN GROUND

1000 ft. No. 6 three-conductor, rubber-insulated, lead-covered, steel-taped cable (600-volt service)	$240
Cost of laying	50
	$290

The figures do not include the cost of relaying the pavement. This, while approximately the same in either case, will be somewhat more for the conduit installation than for the armored cable, because the trench for the ducts would need to be wider and deeper in order to have the ducts far enough underground.

As noted in the table, the difference in cost is mainly due to the much larger expenditure needed for the installation of the duct system. The armored cable itself costs only a nominal sum more than the regular lead-covered cable and its installation is very simple, consisting merely of laying this ready-made cable conduit system directly in a shallow trench and replacing the earth over the cable. The construction of conduit system with its necessary manholes requires plans from which to work and expert superintendence during its construction. In addition to this the cost which is involved by drawing the lead cable into the ducts must be taken into consideration.

Recent Telephone Patents

A patent granted to Mr. E. Neuhold, of Friedenau, Germany, relates to the arrangement of release magnets in a complete automatic trunking system of the Strowger type. According to this invention the circuits of the release magnets are so arranged that all are completely under the control of the calling subscriber, irrespective of whether any of the selectors have failed in action. It will thus be seen that in case of failure there is no disabling of the calling line due to inability to release a connection wholly or partially set up.

Mr. H. P. Claussen has obtained a patent describing a machine-ringing trunk circuit. The ringing key at the "B" end has a magnetic lock which retains it in the operated position until released by the response of the called party. The trunk is especially designed to meet the requirements of a particular switchboard system and provides for the usual operating conditions. This patent is assigned to the Stromberg-Carlson Company.

In a patent granted to Mr. C. C. Bradbury, of Chicago, there is described a rather simple circuit arrangement for a common-battery switchboard. The answering jacks and answering plugs are constructed upon the three-wire basis and the calling plugs and multiple jacks upon the two-wire basis. By this means the usual bridged cut-off relay of the two-wire system may be made of very high resistance, as the circuit of the supervisory relays is completed through the extra spring in the answering jack. This circuit is shown in the illustration. This patent is assigned to the Kellogg Switchboard & Supply Company.

A patent has been granted to Mr. E. R. Corwin, of Chicago, and assigned by him to the Corwin Telephone Manufacturing Company, covering a telephone exchange system. This is a common-battery system of the two-wire type and a very simple arrangement. No line relay is provided, the line lamps being directly connected. A cut-off relay responds to the insertion of the plug, the control of the former being secured through the adjustment of non-inductive resistances.

Auxiliary Telephone Appliances

Mr. C. H. North, of Cleveland, Ohio, is the inventor of a party-line ringing key designed to reduce the number of contacts to a minimum. The key has a push-button for each of the four selections. Each button controls an individual selective current key and in addition engages the plunger of a common master key. The master key is a straight ringing key, the energy supply to which is controlled by the push-button depressed and is operated by a cam which extends into the path of all four buttons and is rocked by any one of them. The button last depressed is locked down by a sliding latch which is driven by a cam.

Mr. E. G. Eidam, of Rochester, N. Y., has obtained a patent for a switching key in which the improvement lies in the details of construction. The frame is made up of sheet-metal punchings pressed into shape.

The telephone may serve as a means of communication between a tug and a barge in tow. A conducting hawser will serve as one side of the circuit and the water for the return. Mr. R. H. Lindal, of Gloucester City, N. J., has obtained a patent for such a system, employing a hawser containing a spiral conductor.

A railway telephone instrument forms the subject of a patent granted to Mr. A. D. T. Libby, of Elyria, Ohio. This instrument is designed to be mounted along the right-of-way, and signaling is accomplished through a lamp. Three sides of the box carry red lenses which are exposed to this light. Telephone apparatus is mounted upon a hinged transverse partition which is fitted with holes at the proper height for allowing the light free exit.

Mr. W. D. Miller, of Butler, Pa., is the inventor of a receiver supporting arm. This is a telescoping arm and is mounted horizontally at the correct height to accommodate the ear. The telephone circuits are switched by a cam engaged by the end of the telescoping arm. The condition of the circuit depends upon whether the receiver is pulled out or pushed back into the position of disuse.

Letters to the Editors

Low-Frequency Lamp Flicker

To the Editors of the Electrical World:

Sirs:—In reference to Mr. C. F. Lorenz's interesting article on page 1146 of your issue of Nov. 30, 1912, and with particular reference to your editorial comment thereon, I should like to point out that while the thermal capacity of the lamp filament has a good deal to do with the degree of flicker shown on 25-cycle circuits, there is another factor which we have observed to enter into the question, namely, the rigidity of the filament and its consequent resistance to mechanical vibration. While a thick filament incidentally has a high thermal capacity, thereby giving a "flywheel" or heat-storage effect and diminishing the influence of the no-current points, it is the rigidity of the heavy filament which plays a part in making such a lamp physiologically preferable when operated on low-frequency circuits. This may be demonstrated among carbon lamps of the same batch. On shaking these it will be observed that the filaments of some oscillate more readily and continuously than others, owing to accidental details of construction in the turns of filament. Putting the lamps in circuit it at once becomes evident that the lamp which shows less tendency to oscillation will show less flicker when used on a low-frequency circuit. From this it appears that there is a mechanical vibration induced by the low-frequency current which, for some filaments, greatly enhances the flicker due to the lighting effects of the current.

We are designating a rigid-filament, non-vibratory, flickerless lamp to be of high "physiological efficiency," as differentiated from watt-per-candle or mechanical efficiency

H. J. Glaubitz,
General Manager Electrical Department.

London, Ont.

The Jobber and the Manufacturer

To the Editors of the Electrical World:

Sirs:—In the Nov. 30 issue a transformer manufacturer is quoted as follows: "The greatest drawback in our field is the inability of the supply-house salesman to compete with the technical experts such as those which two or three of the largest manufacturers maintain. The remedy points to direct representation, which will eventually eliminate the jobber."

I should like to point out that it is not the inability of the supply-house salesman to compete with the technical experts that has changed much of the volume of the transformer business direct to the manufacturer, but the syndication of the electric-light plants which has consolidated their purchases and given the manufacturers an excuse to take their orders direct. I do not think it can be controverted that some of the manufacturers themselves have been mainly responsible for this syndication and consolidation, although their names may not appear directly in regard to the transaction.

I believe the statement is an injustice to the jobbers and that it will be accepted as a fact and misunderstood, thus creating an undue influence against them, not only in transformers but also in other lines of material.

T. C. Ringgold,
General Sales Manager Central Electric Company.

Chicago, Ill., Dec. 19, 1912.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Brake Test on a 75-hp Oil Engine

BY A. A. POTTER AND W. W. CARLSON

While results of many tests on high-pressure oil engines like the Diesel and of medium-pressure, or semi-Diesel, types like the De La Vergne have appeared in print, there seems to be a dearth of data regarding the economy, by actual brake tests, of low-pressure oil engines using low-grade fuel oils.

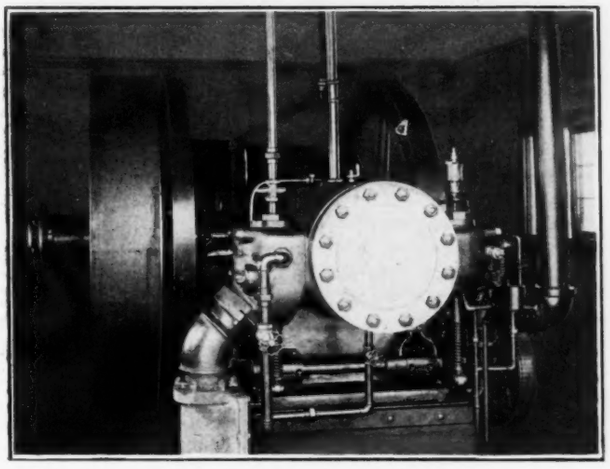


FIG. 1—VIEW OF OIL ENGINE WHICH WAS TESTED

The superiority of the Diesel and semi-Diesel types lies mainly in the fuel economy and there is no question that for units exceeding 100 hp in rating one of these types should be chosen. In the case of power requirements under 100 hp either for the generation of electricity in small power plants or for pumping water the low-pressure types with electric ignition are preferable on account of lower first cost.

A brake test was carried on recently by the authors on a 16-in. by 24-in. horizontal, single-cylinder, low-pressure oil engine, of the four-stroke-cycle type, arranged with mechanically controlled vertical valves on opposite sides of the cylinder, and in which the compression pressure before ignition was about 60 lb. a square inch. Starting was accomplished either by compressed air or by turning back on compression by hand, after a charge of gasoline had been admitted into the cylinder from a glass charge cup over the inlet valve. The engine operated on Solar fuel oil, which was vaporized by the exhaust gases in a coil located entirely outside of the engine cylinder. Ignition of the charge was accomplished by means of a make-and-break igniter with a rotary contact piece. Cooling water was circulated by a rotary pump driven by a belt from the engine crank shaft. A general view of the engine is shown in Fig. 1.

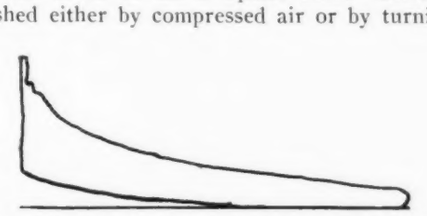


FIG. 2—FULL-LOAD INDICATOR CARD—200-LB. SPRING

During operation water was injected with the fuel, and when properly proportioned the engine ran without noise. Improper regulation of the water spray produced pounding due to pre-ignition of the charge. After continuous operation for several days on Solar oil the inside of the cylinder was examined and found free from any deposit.

The engine was guaranteed by the maker to deliver 75 hp at an elevation of 2800 ft. above sea level when operating at a piston speed of 750 ft. a minute and with a temperature rise of the jacket water of about 120 deg. Fahr. The test was made at an elevation of 2850 ft., the average barometer reading being 26.95 in. During the test the engine was loaded by means of a Prony strap brake placed on a specially constructed, water-cooled pulley.

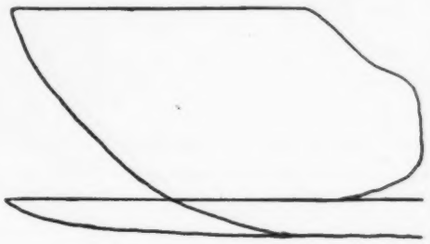


FIG. 3—LOOP CARD AT HALF LOAD—16-LB. SPRING

The various constants for the engine, brake and fuel are given in Table I. Table II shows the average results of the brake tests at full and partial loads, while Table III was calculated in order to show the heat distribution at the various loads per pound of fuel. Since, on account of the decreased density of the charge, the power of an internal combustion engine is decreased about 3.5 per cent for every 1000 ft. elevation, the same engine should develop at sea level about 84 brake hp.

The object of the test being to determine whether the engine would deliver 75 brake hp with a fuel consumption of 1.25 pint per brake hp-hr., the governor was adjusted for the correct piston speed at full load. The variation in speed from full load to the fractional loads was of no consequence in the case of the engine under test, as it was installed to carry a constant load. The running of the engine was perfect and the speed fluctuations slight at all loads below full load.

FIG. 4—CONTINUOUS EXPLOSION DIAGRAM AT FULL LOAD—200-LB. SPRING

In Fig. 2 is shown a characteristic indicator card taken during the full-load test with a 200-lb. spring, while Fig. 3 shows a loop card, taken with a 16-lb. spring and stop. The loop card is advantageous in showing the suction and exhaust phases of the cycle of operations and in revealing defects in the valve mechanism.

A continuous diagram of the explosion pressures obtained for a series of explosions is shown in Fig. 4. This type of diagram is obtained by advancing the paper drum of the indicator by hand while holding the pencil arm against the paper on the drum. The variations in the explosion pressure are probably due to unsteadiness of the governor, producing somewhat uneven compression pressures during successive cycles.

TABLE I—CONSTANTS

Cylinder diameter, in.	16 1/64
Length of stroke, in.	24
Engine constant	0.0122
Brake arm, ft.	4.057
Weight on brake at full load, lb.	517.7
Brake constant	1 ÷ 1294
Kind of fuel	Solar oil
Specific gravity at 60 deg. Fahr.	0.8145
Deg. Baumé	42.0
Lb. per gal.	6.79
Heat units per lb., high.	17,240
Heat units per lb., low.	16,322
Heat units per gal.	117,100

TABLE II—DATA AND RESULTS

	Number of Test		
	1	2	3
Duration of test, hours	3	1	1
Barometer, in.	26.95	26.94	26.95
Speed of engine, r.p.m.	183.5	201.2	202.
Mean effective pressure	75.9	37.1	27.5
Indicated horse-power	85.6	45.5	34.0
Brake-horse-power:			
Maximum	76.0	40.1	20.3
Minimum	68.0	39.43	20.
Average	73.5	39.70	20.2
Mechanical efficiency, per cent	85.8	87.4	59.4
Fuel used, total lb.	222.75	50.1	42.5
Fuel used per i.h.p. per hour, lb.	0.868	1.10	1.25
Fuel used per b.h.p. per hour, lb.	1.010	1.26	2.10
Fuel used per b.h.p. per hour, pints	1.192	1.49	2.48
Heating value of fuel consumed:			
Per i.h.p. per hour, b.t.u.	14,980	18,980	21,550
Per b.h.p. per hour, b.t.u.	17,400	21,750	36,200
Temperature of cooling water, deg. Fahr.:			
Inlet	82.25	79.0	84.25
Outlet	164.0	133.	125.5
Rise	81.75	54.0	41.25
Cooling water used per hour:			
Total, lb.	1,775	2,868	2,712
Per b.h.p. lb.	24.2	72.2	134.2
Thermal efficiency, per cent	14.62	11.7	7.0

The values for the heat distribution per pound of fuel at the various loads, as given in Table III, would indicate that too little jacket water was being supplied to the engine during the test.

TABLE III—HEAT DISTRIBUTION PER POUND OF FUEL

	Number of Test					
	1		2		3	
	B.T.U.	Per Cent	B.T.U.	Per Cent	B.T.U.	Per Cent
Converted into indicated hp.	2,935	17.0	2,315	13.4	2,036	11.30
Converted into brake-hp.	2,520	14.26	2,020	11.7	1,210	7.01
Friction and losses.	415	2.40	295	1.7	826	4.79
Losses in jacket water.	1,955	11.32	3,090	17.9	2,635	15.28
Losses in exhaust, radiation, etc.	12,350	71.68	11,835	68.9	12,569	73.42

The results of the tests and general operation indicate that a good make of gasoline engine with electric ignition, when provided with some form of auxiliary vaporizer which is usually nothing more than a coil placed in the path of the exhaust, will run satisfactorily on oils as heavy as 40 deg. Baumé and will develop a brake-horse-power for an hour on about a pint of fuel.

Hub Expansion of Turbine Wheels at High Speeds

Unless proper precautions are taken, a high-speed turbine wheel expands at the hub a sufficient amount to cause an appreciable increase in the bore, making the wheel slightly loose upon the shaft and soon causing distress.

A paper on the subject of this increase under centrifugal stress, presented by Mr. Sanford A. Moss, West Lynn, Mass., before the American Society of Mechanical Engineers' meeting, New York, Dec. 4, 1912, gave a general discussion of stresses in a rotating wheel and outlined a mathematical method for computation of the increase in bore, checked by actual measurements at high speeds.

The increase of circumference of the bore is found to be proportional to the original circumference and the tangential stress and inverse as the modulus of elasticity. In the experiments the readings showed that the bore expanded at each speed an amount almost exactly equal to the computed values.

For a wheel with 12-in. bore and 30,000-lb. maximum stress, which is permissible with special grades of steel, this increase of bore comes out over 0.01 in., which gives an appreciable loosening of the shaft fit.

For an average case the hub bore expands about 0.6 of the amount of the force fit and for a force fit of 1 mill per inch of bore the radial stress is about 13,000 lb. per square inch and the effective tangential stress is about 27,000 lb. per square inch. For other amounts of force fit the stresses are in proportion.

For the average case above mentioned the pressure to force the hub on the shaft is about 1560 lb. per inch of bore and per inch of hub length for a force fit of 1 mill per inch of bore.

Carrying Capacities for Busbars

Kindly give data for figuring copper busbars for carrying from 5000 amp to 10,000 amp alternating current at low voltages. W. J.

The "Standard Handbook for Electrical Engineers" gives the following data on the carrying capacity, current density, etc., of busbars of various sections:

Size, Inches	Circular Mils.	Amperes.	Amperes per Square Inch.
1 x 1/4	318,310	433	1732
1 1/4 x 1/4	397,290	530	1696
1 1/2 x 1/4	477,465	626	1669
1 3/4 x 1/4	556,400	725	1657
1 1/4 x 1/8	596,830	676	1442
1 1/2 x 3/8	716,200	978	1418
1 3/4 x 3/8	835,600	916	1395
2 x 3/8	954,930	1035	1380
2 1/4 x 3/8	1,074,300	1154	1367
2 1/2 x 1/2	1,591,550	1500	1200
2 1/2 x 3/8	1,989,440	1715	1097
2 x 1/2	1,273,240	1222	1222

By combining the necessary number of such flat sections, leaving spacer blocks and air spaces between the bars, a composite conductor of the required carrying capacity can be built up. In designing solid conductors of such large carrying capacities, the surface area or perimeter of the section may become the controlling factor rather than the actual area of cross-section. Care must be taken, however, that the temperature rise at the center of the section shall not become excessive.

Round sections will be least advantageous for larger buses, because such circular shapes present the least perimeter per unit of cross-sectional area. For round sections hollow tubes would be preferable as securing the greatest ratio of outside surface per unit of cross-section.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Single-Phase Motor with Pole-Changing Windings.—J. S. NICHOLSON AND B. P. HAIGH.—A new type of single-phase commutator motor, the invention of one of the authors, recently installed in the James Watt Engineering laboratories of the University of Glasgow. The principles involved in the use of pole-changing windings in commutator motors are discussed: (1) The compensated series motor. (2) The repulsion motor. Pole-changing stator and pole-changing armature windings and the commutation of the machines are then considered. A typical stator winding for eight and four poles is shown in Figs 1 and 2 and consists essentially of two sets of coils, I, I, and II, II. In Fig. 1 the directions of current in these are such that the winding has eight poles, the conductors being arranged in eight groups, alternatively positive and negative, occupying in this instance four of the six slots of each pole-pitch. On reversing the direction of the current in coils II, II, as shown in Fig. 2, the winding gives four poles, each having eight active slots arranged in two groups of four,

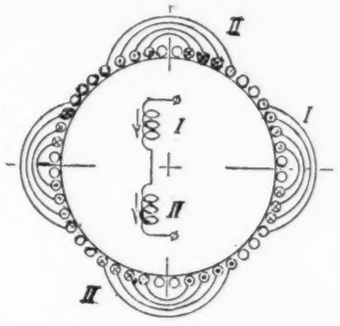


FIG. 1—MOTOR WITH POLE-CHANGING WINDINGS

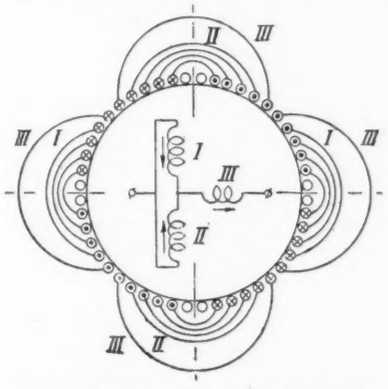


FIG. 2—POLE-CHANGING WINDINGS

separated by groups of two empty slots. As the presence of these latter inactive slots would be undesirable in a stator winding intended for compensating the ampere-turns of the armature, an extra set of coils, III, III, may be added so as to complete four uniform groups of conductors while still leaving four groups of slots in the neutral zones unwound. The three sets of coils are preferably connected so that coils I and II are in series when employed for eight poles and in parallel with one another (but in series with the extra coils, III) when used for four poles. An improved design is shown in Fig. 3, serving not only as an eight-pole field winding, but also as an additional four-pole main winding according to the directions of current in the component coils 1, 2, 3 and 4. When these are coupled in the two pairs, 1, 2, 3, 4, which may be connected in series, as in Fig. 3*a*, or singly, or in parallel, an eight-pole field

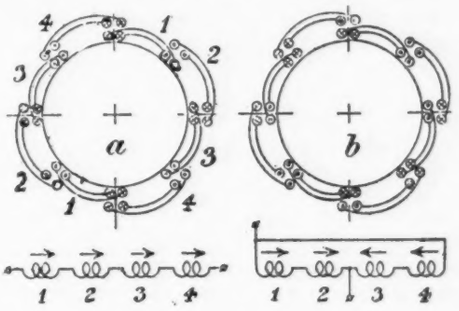


FIG. 3—IMPROVED ARRANGEMENT

is produced covering nearly five-sixths of the total pole area at uniform density. By reversing the currents in coils 3 and 4, while those in coils 1 and 2 remain unchanged, as shown in Fig. 3*b*, the directions of the currents in four of the eight groups of slots are such as to fulfil the purpose of the extra main winding (III, Fig. 2), while the directions of current in the remaining four groups are such as to neutralize one another, leaving these slots inactive so far as external magnetomotive forces are concerned, although subject to copper losses and magnetic leakage. The use of the extra main winding, or of the reconnected field winding, not only improves the overload range of the motor by reducing the stray fluxes but also increases its output in proportion to the voltage induced in the active conductors of the additional winding. The author then takes up pole-changing armature windings. A comparison is made between the relative outputs of the types of machines discussed and a table is given comparing these with the normal repulsion motor. Control connections are illustrated, and finally some details and tests of an experimental motor are given.—London *Electrician*, Dec. 13 and 20, 1912.

Three-Phase Commutator Motors.—A note on a recent British patent (No. 16,790, Dec. 12, 1912) of the Siemens-Schuckertwerke G. M. B. H. To overcome the commutation difficulties with these motors when of large size, and to avoid the replacement of a large motor by smaller ones in purely series connection, whereby the rotors are connected in mesh, the motors are provided with double brush sets, two sets to each phase. By this means the rotor and stator windings of all the motors may then be connected in series. Speed variation may be obtained by shifting the brush sets of each phase. Taking two motors, they may be mechanically coupled, the brush gear of each being mechanically connected to insure the equal distribution of the load. Alternatively, the lead connecting the brushes of the two machines may be connected to a point on the secondary of the transformer. The motors need not then be mechanically connected, and the brushes may be displaced by different amounts.—London *Elec. Eng'ing*, Dec. 19, 1912.

Armature Reaction in Lap-Wound Machines.—W. Lulofs.—The conclusion of his mathematical article. The circulating currents in a lap-wound armature due to unequal pole strengths are usually supposed to produce an armature reaction largely tending to remedy inequalities in the magnetic field. The author shows that only in the case of the four-pole machines is this counterbalancing true. This is in agreement with the fact well known in practice that the four-pole lap-wound machine is far superior to those having more poles. —London *Electrician*, Dec. 20, 1912.

Lamps and Lighting

Tungsten Drawn Filaments.—A note on a recent British patent (No. 18,467, Dec. 12, 1912) of W. D. Coolidge. With dense, coarse powdered tungsten of high purity is mixed between 1 per cent and 5 per cent by weight of the oxides of the rare earths. The mixture is compressed hydraulically. The sticks so produced are heated in a hydrogen tube furnace up to above 1200 deg. C. They are then brought to a very intense white heat by the passage of an alternating electric current in a reducing atmosphere. A previous heating in a vacuum for about half an hour may be given. The removal of impurities is facilitated by the porous nature of the sticks due to the added substances. The size of the sticks may be about ¼ in. square and 6 in. long. They would not be subjected to the full current at first, but about 1400 amp for fifteen minutes, then 1700 amp for fifteen minutes. After this the current would be brought to zero by a reduction of 200 amp each minute.—London *Elec. Eng'ing*, Dec. 19, 1912.

Electrodes for Flame-Arc Lamps.—A note on a recent British patent (No. 27,620, Dec. 12, 1912) of the British-Thomson-Houston Company and the General Electric Company of this country. To prevent the formation of a non-conducting layer of slag on electrodes containing varying amounts of titanium or titanium carbide, from 2 to 3 per cent of cuprous material is added.—London *Elec. Eng'ing*, Dec. 19, 1912.

Illumination.—A Thomälen.—A mathematical article in which the author describes a method for determining the average illumination of rectangular surfaces by calculating exactly the space angles which are obtained by Högner's division of the quadrant.—*Elek. Zeit.*, Dec. 19, 1912.

Generation, Transmission and Distribution

Electric Machinery in Steel Works.—J. Arthur Sykes.—The author points out that the conditions under which machinery is worked in steel works are very severe. Consequently more than usual care must be taken in the selection of plant. It is also necessary to pay particular attention to details, such as the prevention of the accumulation of dust in machines, the maintenance of insulation, etc. As far as possible the plant should be standardized, in order to avoid the necessity of a large number of reserve units, and the arrangement should be such that a breakdown can be remedied with the least possible delay. Breakdowns in cranes are often due to lack of efficient brakes, leading to the running away of motors. Resistor units and their connections are also a frequent source of trouble unless suitably designed.—London *Electrician*, Dec. 13, 1912.

Electrically Driven Rolling Mills.—A list of 203 electrically driven rolling mills in Europe with brief data on equipment and system. There are also a description of the electrical plant for driving the reversing rolling mill at the Skinning Rove Iron Works, and an article by J. J. Fasola on the direct application of the single-winding Sandycroft-Hunt three-phase cascade motor to rolling-mill work.—London *Electrician*, Dec. 13, 1912.

Electric Non-Reversing Mills.—S. H. Eckmann.—After some general remarks on the relative economy of steam and electrically operated mills, the author considers the claims of the reheating furnace with waste heat boiler and steam rolling mill versus the regenerative reheating furnace and electrically driven mill. Different methods of obtaining variable-speed drives are outlined. Improved efficiency and increased output are obtainable by the use of automatic slip regulators. Notes are given on the compounding of direct-current mill motors and a new system is outlined of equalizing a group of mill motors. In addition to the usual shunt field *Sh* and series field *S* each motor (Fig. 4) has a third field winding, *E*, through which flows the total current of the whole group of motors. Any increase of the total current therefore immediately causes all the individual motor currents to decrease and thus discharges, or reduces the rates of charging, all flywheels connected to the system. Motors that happen to be running on light load when a heavy current occurs somewhere in the system may even reverse their current and regenerate into the line, thus easing the demand from the power house. In the same way any decrease of the line current will cause all motors to increase their currents and thus charge their flywheels or reduce their rates of discharge. The illustration shows a special case, where part of the

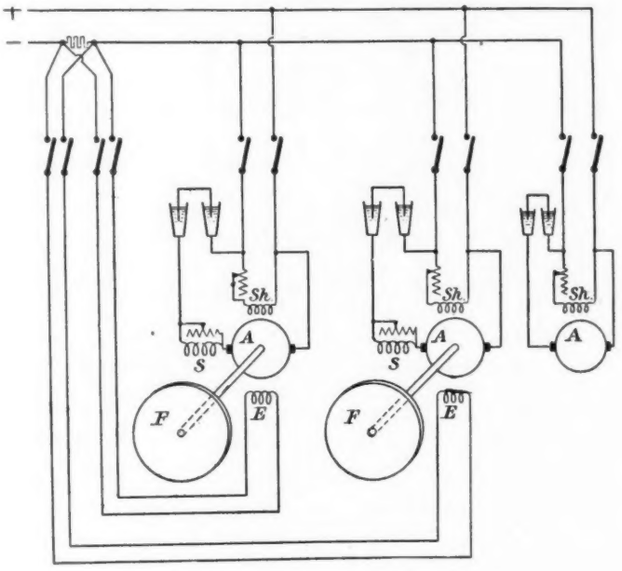


FIG. 4—FLYWHEEL GENERATOR SYSTEM

motors belonging to the system are not equipped with a flywheel at all and where, therefore, the load fluctuations caused by them are smoothed down by the flywheels coupled to the other motors of the system.—London *Electrician*, Dec. 13, 1912.

Peat.—J. Teichmueller.—A continuation of his very long paper read before the German Association of Electrical Engineers on the use of peat in electrical engineering with special reference to the power plant in Ostfriesland utilizing the peat deposit of the Wiesmoor. The plant is a turbo-generator plant, the peat being utilized as fuel for the boilers. Under these conditions with peat dried in the air, but not completely free from moisture, 2.5 kg (55 lb.) of peat produces 1 kw-hr. under ordinary conditions of service, or 400 kg (880 lb.) produces 1 ton of peat. The price of the peat being $1.25 per ton, the cost of fuel is about 0.3 cent per kw-hr., which compares well with the results obtained in other German plants where bituminous coal is used for firing. Still better results can be obtained with peat if it is used in a gas producer with gas engines operating according to the Frank-Caro process, with recovery of ammonium sulphate as a by-product. This system is in use in a plant which supplies energy to the city of Osnabrück. In this case 2 kg (4.4 lb.) of peat is consumed per kw-hr. The author gives details of the transmission-line construction. The paper is to be concluded.—*Elek. Zeit.*, Dec. 19, 1912.

Wind Motors.—W. A. P. TURNBULL.—An illustrated description of a new type of wind motor for generator driving which was exhibited at the Sydney Agricultural Show. The special feature is the method of speed regulation. This is shown diagrammatically in Fig. 5, in which *a* is a plan and *b* an elevation of the apparatus. The wind wheel *X* runs on shaft *D*, which is rigidly connected to casting *Z*, which is pivoted at *F* on the supporting tower. The center line of shaft *D* is to one side of the center line of the pivot and tail apparatus. The tail of the mill *T* is free to turn horizontally on a fulcrum *Y* rigidly supported from the casting *Z* through frame *L*. The other end of the tail arm is, however, restrained in its movement by a weight *W*, to which it is attached by a rope running over a pulley *P* carried on the framework. The regulation is automatic. When the wind is blowing in the direction shown by the arrow *K*, the wind-wheel tends to turn out of the wind in the direction shown by the arrow *O*. The wind, however, tends to keep the tail *T* in the direction of the wind. If *W* were made extremely heavy, the tail would act as though rigidly connected to *Z*, and the regulation would be unstable. The weight, however, is so adjusted that the resultant of the two parallel forces acting at each end of the tail at right angles thereto, and which takes effect on *Z* through the pivot *Y*, balances the turning movement of the main wheel

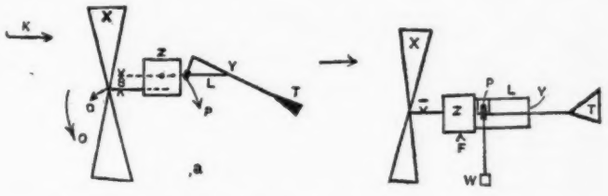


FIG. 5—DIAGRAMMATIC VIEW OF WIND MOTORS

about the vertical axis of *F* in such a manner that the wind-wheel turns out of the wind or into the wind according to whether the wind velocity rises or falls. The wheel then revolves at practically constant speed over and above a maximum wind velocity—generally fixed at from 10 to 15 miles per hour. No matter what hurricane is blowing, the speed of the wind-wheel does not exceed this maximum, turning right out of the wind momentarily when the gusts are very severe but maintaining the constant speed.—London *Elec. Review*, Dec. 20, 1912.

French Water Powers.—Some notes on the rapid development of water-powers in France. The greatest project is the development of the water-power of the Rhone River, where a power plant of 240,000 kw is being erected. The largest part of the energy is to be transmitted at 120,000 volts to Paris, the distance being 430 km (260 miles). The principal hydroelectric companies of France have combined and formed a syndicate. The total rating of the water-power plants represented in this syndicate is now 575,000 hp, of which one half is sold for lighting and industrial purposes and the other half is used in electrochemical and electrometallurgical plants. The total rating of the water-powers available in France is estimated as 5,000,000 hp with a low-water level of 10,000,000 hp with average water level. A great deal therefore remains to be done to utilize this power. Much is expected from the electrification of railways and many of the French railway companies make experiments, but so far only 10,000 hp is utilized for electric traction on trunk railroads in France.—*Elek. Zeit.*, Dec. 19, 1912.

Traction

Electrification of London Railways.—An article on some electrification schemes of the London & Northwestern Railway and the London and Southwestern Railway. The former will electrify 79 miles of track, the latter 73 miles. Both are adopting the continuous-current system at 600 volts pressure, the former with third and fourth rails, and both companies will have their own power stations.—London *Electrician*, Dec. 13, 1912.

Berlin.—A continuation of the memorial of the Railway Department of the government concerning the electric operation of the Berlin City, Loop (Ring) and Suburban railways. Data are given on the changes in the design of the steam locomotives which would become necessary with the intended greater rapidity of succession of trains in case steam traction was used. Comparative figures are given on the use of electric and steam traction. The first installation is considerably cheaper for electric traction (about $1,470,000 against $2,000,000 for steam traction), while the cost of operation is practically the same in both cases.—*Elek. Zeit.*, Dec. 19, 1912.

Installations, Systems and Appliances

Scrapping Plant at London.—A note stating that four 3500-kw reciprocating engines and generators at the Greenwich power station are to be replaced by four 8000-kw turbo-generators, the total equipment rating being thus increased from 34,000 kw to 52,000 kw, although the reciprocating plant was put down only ten years ago and was far from having completed its useful life. The work will be carried out in two stages, two sets at a time. The reciprocating sets together cost about $595,000, whereas the cost of replacing them, including the provision of an overhead crane and making certain alterations, will be about $1,135,000. The book value of the present plant when discarded will be about $375,000. On the other hand, the saving in fuel with coal at $2.75 per ton is estimated at $57,150 for the first two turbines, and this is sufficient to meet the debt charges on the first portion of the new plant. —London *Electrician*, Dec. 13, 1912.

Safety Device for Electrical Machinery for Coal Mine.—D. BOWAN AND W. E. FRENCH.—The composition of firedamp is considered, and the results of experiments on the ignition temperatures of different gases are given. The velocities of inflammation of a gas under constant volume are discussed and pressure curves are given. Experiments with safety devices and the phenomenon of "after-burning" with gauze-protected apparatus are explained. The details of a number of flame-proof devices for mining work are criticised. Oil protection is dealt with and some oil-immersed machinery of British manufacture reviewed in detail. Gauze, plate, labyrinth and tube protection are further discussed.—London *Electrican*, Dec. 20, 1912.

Electrophysics and Magnetism

Gravitation.—JUN ISHIWARA.—A paper on the theory of relativity with consideration of gravitation. The author starts from the fundamental equations of the electromagnetic theory, assuming the velocity of light not to be constant, and shows how on this basis it is possible to derive Abraham's gravitation formulas and also the result that the gravity of a system is proportional to its energy. In the fundamental equations of electromagnetic phenomena as well as in the equations of the field of gravitation the square root of the velocity of light is an item of particular importance.—*Phys. Zeit.*, Dec. 15.

Electric Constriction.—E. F. NORTHRUP.—An article describing a curious manifestation of electric constriction showing pressure forces in a liquid carrying a current, due to the pinch effect.—*Met. and Chem. Eng'ing*, January, 1913.

Electrochemistry and Batteries

The Electric Furnace in the Production of Iron from Ore.—D. A. LYON.—An illustrated article pointing out that the use of the electric furnace in the production of iron from ore while restricted to certain countries with special conditions has now entirely passed the experimental stage in view of the fact that commercial iron-ore-reduction furnaces are running in California and Scandinavia. Com-

parison is given of details of the practice in California and Scandinavia, especially with reference to reduction in shaft, to gas circulation and use of calcined limestone. The author indicates the lines along which the electric furnace will probably be improved and its efficiency raised. He concludes that the electric iron-ore-reduction furnace is meeting the requirements in those localities where it has been introduced, and that it will no doubt find extended application in those countries where the conditions are favorable to its introduction, namely, where electrical energy is comparatively cheap and where coke and charcoal are comparatively high. Inasmuch as the cost of electrical energy is largely the governing factor in determining its adoption, and as the cost of electrical energy is constantly decreasing, we may expect to find an extended application of the electric reduction furnace in the future.—*Met. and Chem. Eng'ing,* January, 1913.

Induction Furnace.—J. Harden.—After some general remarks on induction furnaces, the author gives a survey of the conditions obtaining in various steel-producing countries. It is rather in the production of special classes of steel than of steel such as is used in armor plate, and of which the specification is not so exacting, that the induction furnace will find its place. In the production of high-grade steels the cost of electric energy is not very important so long as the resulting product is good. The characteristics of the induction furnace render it particularly applicable to this class of work. In conclusion, details are given of the construction of induction furnaces and of the way in which it has been found necessary to make the furnace linings.—London *Electrician,* Dec. 13, 1912.

Units, Measurements and Instruments

Measurement of Temperature by Electric Means.—C. B. Thwing.—An article discussing critically the general principles and the limitations of simple thermocouples, reduction pyrometers with thermocouple and electric resistor pyrometers. In selecting pyrometers the temperature range is one of the first considerations. For temperatures with a maximum range above 1500 deg. C. (2732 deg. Fahr.) the radiation type is the only one of the three which is available. The lower limit for this type of instrument is ordinarily about 500 deg. C. (932 deg. Fahr.). Where the upper limit is 150 deg. C. choice may be had between the radiation and the platinum thermocouple. Where the upper range is 1200 deg. C. (2192 deg. Fahr.) the chrome-nickel thermocouple, the platinum thermocouple and the radiation type may all be used. For temperatures up to 1000 deg. C. (1832 deg. Fahr.) the iron-constantan thermocouple and the nickel resistor could be employed, with the choice probably in favor of the resistor type. The form and size of the thermocouple or resistor bulb are also determined by circumstances. Where large heat areas are under consideration, with slow changes of temperature, the thermocouple may be of large cross-section and thoroughly protected with iron or refractory tubes. Where the bodies to be measured are small and the temperature fluctuations are very rapid the thermocouple must be made smaller. For example, if the transformation point of a number of specimens of steel is to be determined, it is desirable that the specimens be small, with a small opening into which a very small thermocouple is inserted. The same considerations which make the thermocouple small would determine the choice of the thermocouple as against the resistor bulb, since the former can be made almost infinitesimally small and will respond with corresponding quickness to the temperature of the inclosing body. Where thermocouples are used the greatest consideration must be given to the matter of cold-end variation, and in the installation the most complete precaution must be taken in the matter of wiring to make sure that all joints are permanently made. In the case of resistor thermometers the failure to get good results is often due to the failure to protect the lead wires from moisture or from abrasion.—*Met. and Chem. Eng'ing,* January, 1913.

Thermal Emf of Tungsten and Molybdenum.—E. F. Northrup.—An article on the determination of the thermal emf of tungsten and molybdenum. A diagram giving the emf as a function of the temperature shows that this curve reaches a maximum at 530 deg. C. and comes back to zero at 1060 deg. C. The author recommends that many samples of tungsten and molybdenum be tested. If they all have a neutral point at 1060 deg. C., a thermocouple of these metals would serve in a very convenient way to fix this temperature. A couple or a resistor thermometer to be tested would be put in the same electric oven with the tungsten-molybdenum couple and the temperature raised until the latter showed zero emf. The temperature would then be 1060 deg. C.—*Met. and Chem. Eng'ing,* January, 1913.

Telegraphy, Telephony and Signals

Telegraph Currents.—K. W. Wagner.—A conclusion of his paper, illustrated by numerous diagrams, on a new artificial telegraph line for investigating phenomena of telegraphy. Since the transient phenomena or short natural lines are very often so quick that they cannot be determined directly by means of the oscillograph, the artificial line of the author is so designed as to change all the time constants in a certain ratio; the transient phenomena in the artificial line are then retarded in the same ratio, but are otherwise not changed or distorted. In the second part of the paper the author gives several oscillograms which have been taken with the artificial line to investigate several problems in practice. One of these is the use of alternating-current signals for telegraphy. It has been claimed that this system permits transmission to a greater distance, but this is a mistake since an alternating-current signal consisting of a number of impulses and reversals changes while being transmitted over a long line into one single broadened and flattened impulse. Other subjects discussed are the current at the distant end with different lengths of line, the connection in series of lines of different characteristics, and the use of protective devices against abnormally high voltages.—*Elek. Zeit.,* Dec. 19, 1912.

Book Review

Calculs Techniques et Économiques des Lignes de Transport et de Distribution d'Energie Électrique. First part. By C. Le Roy. Paris: A. Hermann & Sons. 172 pages, 52 illus. Price, 6 francs.

A very practically presented elementary textbook on the design of electric conductors for the transmission of energy. The design includes a discussion of the heating, efficiency, economy and pressure regulation of the conductors. Various practical examples are examined, numerically, from an engineer's point of view. The nine chapters of the work relate to the following subjects: Considerations determining the choice of the size of conductors; conditions for safety of operation; conditions for satisfactory service; conditions for good economy; design of distributing conductors; resistance of wires; design of lines with reference solely to their resistance, inductance, reactance and impedance; design of transmission and distribution lines taking their reactance into account. It is unfortunate that a distinct difference of terminology exists between the French and English languages in regard to inductance and reactance. What is called inductance in English is sometimes described as "self" in French and what is called reactance in English is then described as inductance in French. This serious discrepancy in terms should soon receive international consideration and elimination in order to facilitate interchange of ideas among engineers of different nations.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Showcase Lighting

In selecting a showcase lighting system several important points should be considered. The illumination of the interior of the case should be approximately double that of the general illumination of the store; the light should be of such an intensity and quality that the goods are shown in their true color and style; the temperature of the interior of the case must not be raised to any appreciable extent, and any increase, however small, should be evenly distributed, as a plate glass which is warm in spots is liable to crack when cold drafts strike it. Moreover, the lighting unit should be neat and inconspicuous and permit of easy and thorough cleaning of the case.

FIG. 1—SHOWCASE REFLECTOR

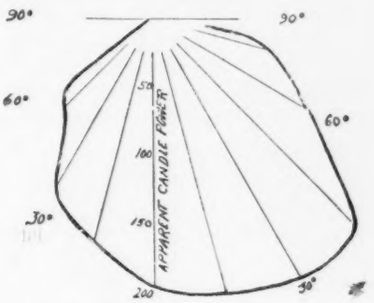


FIG. 2—DISTRIBUTION DIAGRAM

The Linolite lamp, it is claimed, meets these conditions very satisfactorily. This lamp is approximately 1 ft. long and 1 in. in diameter. The tungsten metal filament is concentric to the tube and extends its entire length. The interior glass area of the lamp is 31 sq. in., as against 17 sq. in. for the ordinary "bunghole" type of lamp and 24 sq. in. for the ordinary incandescent lamp of the same rating.

FIG. 3—SHOWCASE LIGHTED WITH LINOLITE LAMPS

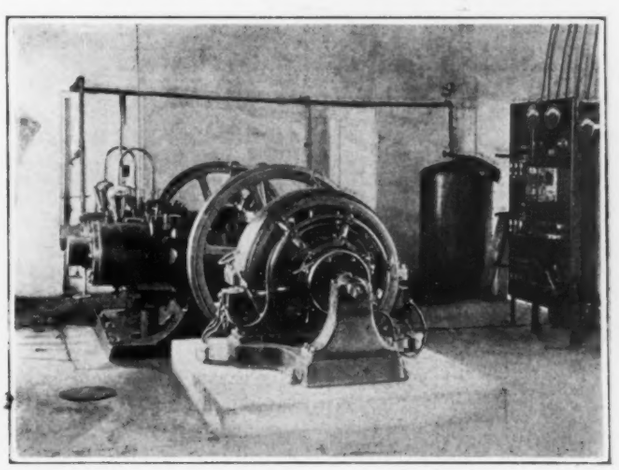
This large glass area is said to insure low temperature and long life. On account of its shape the lamp also adapts itself to a very small reflector.

The illustrations show the application of the Linolite system of showcase lighting in the store of Lipman, Wolf & Company, Portland, Ore., where over 3000 ft. of Linolite is in use. Fig. 1 shows a reflector 2.5 in. deep and 2 in. high, which distributes the light as shown in Fig. 2. The aisle cases in Fig. 3 are 30 in. deep and 32 in. high and are equipped with four Linolite lamps for each 8 ft. of frontage, while the wallcases are 24 in. deep and 36 in. wide with three lamps to each case. The art exhibit is shown in Fig. 4. The depth from the posts to the back of the case is 3 ft. 6 in. and from the ceiling to the counter 5 ft. 6 in. The Linolite lamps used in the specially designed wallcase reflector are rated at 35 watts. The installation was made by the H. W. Johns-Manville Company, New York.

FIG. 4—STATUARY EXHIBIT ILLUMINATED BY LINOLITE LAMPS

Oil-Engine Operation at Paullina, Ia.

Paullina, Ia., a town of 1000 population, installed a 50-hp oil-engine generating equipment about two years ago. The plant comprises a two-cylinder horizontal Mietz & Weiss oil engine, operating at 275 r.p.m., directly coupled to a 30-kw, 110/200-volt direct-current generator by means of a flexible coupling. Besides supplying lighting for the business and residential sections, a moving-picture show and 149 tungsten street lamps are operated from the equipment. In the business section a number of five-lamp tungsten



OIL-ENGINE PLANT, PAULLINA, IA.

standards are employed. The plant, with pole line, equipment, etc., was installed complete by the Interstate Electric & Manufacturing Company.

From the annual report of the town officials the following figures are taken for the cost of operation of the plant from April 1, 1911, to March 31, 1912, during which period the income from lighting service was $3,793.95. This is exclusive of street lighting, for which no charge was made: Salary for superintendent of public works, $1,320; repairs for plant, including miscellaneous supplies, etc., $65.58; fuel for plant, $339.63; lubricating oil for plant, $43.98; outlay for plant during year, $1,769.19.

The above figures do not include, of course, charges for capital invested in the plant, depreciation, taxes, etc. In addition to the difference of $2,024.76 shown in favor of plant income over the items of outlay tabulated, it is estimated that the street lighting furnished would have cost $1,500.

The oil-engine equipment has proved very economical to operate and has given extremely satisfactory service, including many long record runs without trouble or shut-down. For pumping its water supply the town of Paullia recently purchased from the manufacturer, August Mietz, 87 Elizabeth Street, New York, an additional 18-hp oil engine of the same type.

Portable Electric Drills

The Standard Electric Tool Company of Cincinnati, Ohio, has placed upon the market a line of portable electric drills in four sizes, namely, ¼ in., 5/16 in., ½ in. and ¾ in. The drill motors will operate with either alternating or direct current and, it is stated, will give equal satisfaction on low-frequency circuits or on 60-cycle mains. This

PORTABLE ELECTRIC DRILL

versatility has been brought about through the use of series-commutating type motors of special design. High power, absence of tendency to run hot and an improved method of forced ventilation are the features claimed for these drills. The motors have been so designed that they will not race under light load, consequently twist drills are less frequently burned and no damage results if the tool runs idle.

A switch placed in the handle of the drill gives to the operator full control of the apparatus at all times. All armature spindles and the gears in the two largest sizes run in ball bearings. The gears are made of chrome-nickel steel, case-hardened, and are supported on both ends and incased in grease.

Insulated Wire

The Underwriters' tests are much more severe on the smaller sizes of 1911 code wire than on the larger sizes, and where the same quality of insulation is used throughout it is considered the best practice to increase the voltage tests more on the larger sizes of wire. The Simplex Electrical Company, 201 Devonshire Street, Boston, Mass., claims that all of its 1911 code wire "Simcore" is subjected to the following tests for one minute:

Size, B. & S.	Required by Underwriters, Volts	Applied to Each Length of "Simcore," Volts
14 to 8	1500	2000
6 to 2	2000	3000
1 to 0000	2500	5000
225,000 to 500,000	3000	6000
525,000 and larger	3500	7000

From the above it will be noted that the voltage tests applied are much in excess of those required by the Underwriters, being in the larger sizes as much as 100 per cent more.

Storage-Battery Industrial Trucks

By Adrian D. Stevenson

The genesis of the electric truck is found in the necessity of some automatic device that would not only supplant the cumbersome hand truck but also in certain cases afford a cheap substitute for industrial railways, locomotive cranes and trolley cranes.

A simple industrial electric truck is built in sizes and capacities suitable for moving loads on piers, in freight sheds, warehouses and industrial establishments generally. Its clearance and radius of action permit it to pass through congested places, and it goes forward or backward with ease and facility and is capable of ascending gradients of 25 per cent. On piers and in railway terminals it can deliver its load on the deck of a vessel or within a freight car; in a warehouse or store it can carry its load from floor to floor wherever wanted with a degree of celerity otherwise impossible; in the factory it carries materials di-

WEEK'S RECORD OF STORAGE-BATTERY TRUCK HAULING TRAILERS

Number of packages handled	7570
Average weight per package, lb	230
Total weight handled, tons	900
Average distance packages were moved, ft	900
Percentage of time machine was working	80
Number of packages delivered per working minute	3
Number of different jobs worked on	30
Heaviest single load drawn, tons	12.5
Cost of operator, interest, depreciation and energy	$24.00
Cost of moving one package 900 ft., cents	0.33
Cost of moving one ton (nine packages) 900 ft., cents	3

rectly to the place where needed and at the precise time when needed, something impossible with moving apparatus working on a fixed track, and at the same times does it more quickly and more economically than it can be done with hand trucks. The capacity of these trucks is usually 2000 lb., that having been found the limit for trucks with the widest range of action. The larger sizes must of necessity take up more room and as the size increases the greater clearances are required. The size and style suitable for a particular business always depend on the working conditions. For the great majority of cases, however, the truck of 2000 lb. capacity is ample. Few hand trucks are required to carry this much, and when they do they require several men to pull them. The speed upon the

level is 7 miles per hour and their radius is 25 miles on a single charge of the battery. By changing batteries a twenty-four-hour service may be maintained. One of these trucks is capable of doing fifteen times as much work as one man and a hand truck can do in a given time. The operation of such a truck is sufficiently simple to permit of the usual labor employed for hand trucks. The power required for a full charge of the battery averages 6 kw.

It must be obvious that the adoption of this device is of great benefit to the central station. There is hardly a city but where hundreds of these vehicles can be used. One element is of particular moment, and that is the possibility of doing away with the greater part of the elevator equipment, as these trucks are readily capable of using an incline which is equally quick and saves the elevator expense. The advantages over conveyor systems are that the radius of the truck is unlimited and the investment much less. Furthermore, the system of using motor trucks is capable of unlimited expansion without regard to the existing equipment. This is not true of conveyor systems, and the chance for expansion is always limited in case of trainways.

The storage-battery crane truck is one application of the motor truck. Its function is somewhat different. This

FIG. 1—ELECTRIC TRUCK SHOWING DRIVER'S STAND

truck finds its use in the loading and unloading of freight and also in shifting packages where the weights are less than 1 ton and where the use of locomotive or trolley cranes would not be practicable. The tractive effort of the crane motor is sufficient to pull a number of trailers. Its drawbar pull is 2000 lb. on wood-block paving, which is the equivalent of a 5-ton locomotive on rails. It is sufficient to move loaded freight cars and readily to handle loads of from 5 tons to 8 tons on trailers. Where hauls are short the hoists carry the package on the hook to the place where it is wanted, thus combining lifting, carrying and dropping in practically one effort. Owing to its short wheelbase and its clearance, the radius of action thus afforded is greater than that of any other device. The following examples taken from actual practice over an extended period will give an idea of what can be expected of the storage-battery crane truck:

By the pick-up-and-carry method sixty 800-lb. barrels of plumbago were removed 300 ft. in an hour and only one helper was used; 150 300-lb. boxes of rubber were loaded into a box car 75 ft. distant in fifty minutes. On the preceding page the record of an average week's work performed by a storage-battery truck in hauling trailers is given in tabular form.

Having thus outlined the function of the storage-battery truck, attention may be called to the magniude of its field and its possibilities with reference to establishing a high degree of efficiency in the handling of free-flowing freight and merchandise generally. First on the list in matter of importance is the railway freight terminal.

The freight terminal presents a peculiar situation. Located usually and necessarily in a congested portion of a city, the opportunities for expansion are decidedly limited.

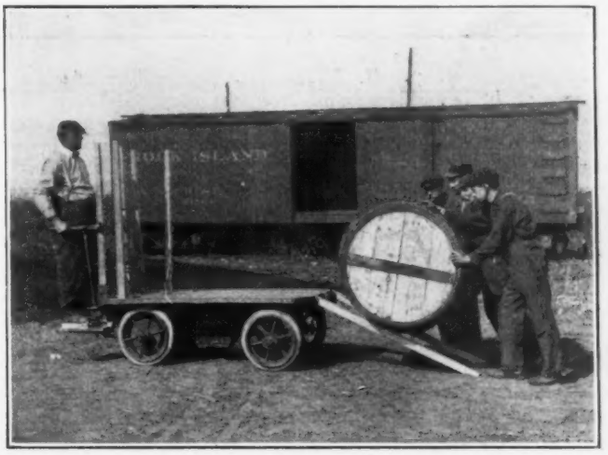


FIG. 2—A QUICK MEANS OF MOVING HEAVY BARRELS

With the present methods of handling freight the increase in business is met either by purchasing additional real estate or by suffering delay and congestion. The present value of freight terminals is based purely on ground-floor area. The upper area is valueless. It would therefore seem that the ultimate relief is to be found in the utilization of upper floors. The motor truck becomes a primary factor in the utilization of space heretofore useless, as it can readily ascend permanent or moving inclines or can be used in connection with elevators, whichever the situation may call for.

From information gathered from the Interstate Commerce Reports and various papers bearing on the subject, the cost of handling freight amounts to 60 per cent of the

FIG. 3—TRUCK IN OPERATION

total cost of transportation; that is, for every dollar spent in the transportation of freight 44 cents goes for handling. If, therefore, this cost of handling can be reduced by the introduction and use of motor trucks it would seem that a very desirable result had been accomplished.

The trucks illustrated in this article are made by the General Vehicle Company, Long Island City, N. Y.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Personnel of New J. G. White & Company Subsidiaries.—The plan of the officers and directors of J. G. White & Company, Inc., to segregate the latter's engineering and operating departments through the formation of two new corporations, one to be known as The J. G. White Engineering Corporation and the other as The J. G. White Management Corporation, as was described in these columns Nov. 23, has been approved and officers and directors for the two new companies have been elected. The directors of The J. G. White Engineering Corporation are as follows: Harry Bronner, of Hallgarten & Company; James Brown, of Brown Brothers & Company; F. Q. Brown, of Redmond & Company; Douglas Campbell, of Campbell, Harding & Pratt; George C. Clark, Jr., of Clark, Dodge & Company; Bayard Dominick, Jr., of Dominick & Dominick; A. G. Hodenpyl, of Hodenpyl, Hardy & Company; T. W. Lamont, of J. P. Morgan & Company; Captain Marion McMillin, of Emerson McMillin & Company; J. H. Pardee, president The J. G. White Management Corporation; E. N. Potter, of Potter, Choate & Prentice; Frederic H. Reed, vice-president J. G. White & Company, Inc.; Charles H. Sabin, vice-president Guaranty Trust Company; Frederic Strauss, of J. & W. Seligman & Company; Moses Taylor, of Kean, Taylor & Company; George H. Walbridge, of Bonbright & Company; E. N. Chilson and C. E. Bailey. The officers are: J. G. White, chairman finance committee; Gano Dunn, president; E. G. Williams, A. S. Crane, H. A. Lardner, vice-presidents; H. S. Collette, secretary, and R. B. Marchant, treasurer. The directors of The J. G. White Management Corporation are as follows: Cecil Barret, of Spencer Trask & Company; F. Q. Brown, of Redmond & Company; P. M. Chandler, of Chandler Brothers & Company, Philadelphia; Arthur Coppell, of Maitland, Coppell & Company; Gano Dunn, president The J. G. White Engineering Corporation; George E. Hardy, of Hodenpyl, Hardy & Company; R. G. Hutchins, Jr., vice-president National Bank of Commerce; R. L. Montgomery, of Montgomery, Clothier & Tyler, Philadelphia; John T. Pratt, of Campbell, Harding & Pratt; Frederic Strauss, of J. & W. Seligman & Company; H. R. Tobey, of N. W. Halsey & Company, and J. G. White, president J. G. White & Company, Inc. The officers are: J. H. Pardee, president; F. H. Reed and S. L. Selden, vice-presidents, and T. W. Moffat, secretary and treasurer. The business of the Management company was established some years ago as a department to supervise the operation of properties in which J. G. White & Company, Inc., was interested. This department, which has now been formed into a separate company, was, on Dec. 31, 1912, acting as operating and consulting manager of public utility and railroad properties in the United States, Nicaragua and the Philippine Islands, including the Manila Electric Railroad & Lighting Corporation and subsidiaries; the Helena (Mont.) Light & Railway Company; the Eastern Pennsylvania Railways Company, of Pottsville, Pa., and subsidiaries; the United Light & Railways Company and subsidiaries; the Associated Gas & Electric Company and subsidiaries; the Augusta-Aiken (Ga.) Railway & Electric Corporation and subsidiaries; the Pacific Railroad of Nicaragua; the Kentucky Public Service Company and subsidiaries, and other properties. The parent organization, J. G. White & Company, Inc., controls the new companies and will continue as an active financing and owning company.

1912 Copper Production Was Largest on Record.—Statistics and estimates received by the United States Geological Survey indicate that the copper output in this country in 1912 exceeded that of any previous year in the history of the industry. The smelter output, based upon returns for eleven months and estimates for the month of December, was 1,249,000,000 lb. in 1912, against 1,097,232,749 lb. in 1911. The average quoted price of electrolytic copper for the year showed a marked increase over that for 1911. The average for 1912 was about 16 cents per lb., as compared with 12.5 cents per lb. for 1911. The year opened with copper at about 14 cents per lb., but from June on the monthly average did not fall below 17 cents. Figures published by the Copper Producers' Association show a production of refined copper amounting to about 1,570,000,000 lb. in 1912, as against 1,433,875,026 lb. in 1911. Stocks of refined copper held in the United States on Jan. 1, 1913, were 105,312,582 lb., as compared with 89,785,000 lb. on Jan. 1, 1912.

Activities of Siemens & Halske A. G.—Owing to the increasing business of the Siemens companies in Canada, the Siemens Company of Canada, Ltd., has been formed with principal offices in the Transportation Building, Montreal, and Mr. Arthur S. Herbert as general manager. Branch offices have been opened in 305 Standard Bank Building, Toronto, and in the McArthur Building, Winnipeg. The Siemens & Halske A. G. reports increasing orders for automatic and semi-automatic telephones for private and public purposes abroad. The company recently received an order for two exchanges for Rome of 2000 subscribers each. Many factories and hotels, the company says, are installing automatic telephones. Since 1909 the Siemens & Halske A. G. has installed 70,007 automatic and semi-automatic telephones in various European communities for public and private use.

Utah Power & Light Increases Its Holdings.—The electrical properties of the Utah-Idaho Sugar Company, including a 7000-kw generating station on Bear River near Collinston, Utah, have been sold to the recently organized Utah Power & Light Company for $600,000. The purchasers are planning to develop energy on a large scale along the Bear River and have several hundred men engaged on construction work in that territory. The properties of the San Juan Water & Power Company, of Durango, Col., which has a power station at Tacoma, about 20 miles from Durango, have also been acquired by the Utah Power & Light Company. The latter has obtained options on the Delta Electric Light & Power Company, of Delta, Col., and on the electric-service properties at Montrose and Ouray, Cal.

Large Demand for Heating Appliances.—Mr. Roger Williams, of the New York office of the Simplex Electric Heating Company, said this week to a representative of the *Electrical World* that in October, November and December last he sold over 50 per cent more electric-heating appliances than he did in the corresponding period of 1911. A stock received at the end of September, 1912, and amounting to more than 50 per cent in excess of that sold in the last quarter of 1911, was sold before the close of October, so that the volume of business in November and December added to this made a total considerably ahead of that in the last three months of 1911. Toasters and chafing dishes were in greatest demand, he said, with that for the former predominating.

General Electric's 1912 Gross Exceeded $100,000,000.—It is learned from an authoritative source that the business of the General Electric Company in the fiscal year ended Dec. 31, 1912, was the largest in the history of the company. Gross earnings amounted to approximately $102,300,000, which compares with $70,383,854 in 1911.

New York Edison's Showrooms Busy.—During the week ended Dec. 21, 1912, 119 orders for electric appliances were received at the various showrooms of the New York Edison Company. These amounted to a total of $936 and called for appliances aggregating 41 kw in rating.

Large Gain in New Incorporations Last Year.—Not in six years have incorporations been made on such a large scale as was the case in 1912. According to compilation by the *Journal of Commerce*, New York, the new companies organized in the Eastern States in 1912, representing a capital of $1,000,000 or more, as well as increases in capital, aggregated $2,295,172,000, which is $457,740,600 in excess of the 1911 total. Adding capital represented by incorporations in states other than those in the East increased the total to $2,647,271,000. Counting in companies in all the states with a capital of $100,000 and over, but less than $1,000,000, the grand total for the year was $3,288,245,000, as against $2,906,001,850 in 1911 and $2,869,073,742 in 1910. Among the largest incorporations of the year in the Eastern States were the $70,000,000 Tennessee Railway, Light & Power Company, the $50,000,000 Continental Public Service Company, the $53,000,000 Chicago Utilities Company, the $40,000,000 American Public Utilities Company, the $40,000,000 Puget Sound Traction, Light & Power Company, and the $30,000,000 Havana Electric Railway, Light & Power Company.

New Allis-Chalmers Company to Begin Operations Soon.—The reorganization committee of the Allis-Chalmers Company hopes to have all details of the reorganization completed and to have the new company in operation early in March. The members of the executive committee and most of the principal officers of the new company, which is to be formed after the foreclosure sale to be held on Feb. 3, will be Milwaukee men. Payment of the third assessment, in accordance with the reorganization plan, is due on Jan. 15. The date for the final payment will probably be set a short time before the new company begins operations, so as to provide additional working capital for it.

Commonwealth Power, Railway & Light's Common Dividend.—Directors of the Commonwealth Power, Railway & Light Company, which operates in Michigan, have declared an initial dividend of 1 per cent on the company's $12,000,000 common stock. This is payable May 1 to stock of record April 10. The regular quarterly dividend of 1½ per cent on the $6,000,000 preferred stock was also declared. This is payable Feb. 1 to stock of record Jan. 14. As was stated Dec. 28, the action on the common stock was anticipated by a majority of the stockholders in view of the substantial gains that were made last year in the earnings of the company.

Brazilian Traction, Light & Power Gains.—Increases in both gross and net earnings continue to be made by the Brazilian Traction, Light & Power Company, which was formed last summer, as noted in these columns, through consolidation of the Rio de Janeiro Tramways, Light & Power Company, the Sao Paulo Tramways, Light & Power Company and the Sao Paulo Electric Company. The November gross was $1,773,623, as compared with $1,770,187 in October and with $1,691,298 in September. Net earnings in November were $1,006,271, and those in October and September were $1,004,329 and $953,901 respectively.

Pennsylvania Utilities Merged.—The Allegheny County Light Company, the Monongahela Light & Power Company, the Southern Heat, Light & Power Company, the Ohio Valley Electric Company and the Oakmont & Verona Light, Heat & Power Company, all owned by the Philadelphia Company, of Pittsburgh, have been merged with the Duquesne Light Company, which is controlled by the same interests. The Duquesne company, as noted in these columns Dec. 28, recently increased its capital stock to $25,000,000 in connection with this merger.

Northern California Power Company to Make Improvements.—It is stated that about $225,000 will be spent this year by the Northern California Power Company of San Francisco upon improvements and extensions to its system in Shasta County. Among the work that will be done are the building of a reservoir on Dry Burney Creek and the installation of equipment to double the present ratings of the power stations at Kilarc and South Cow Creek.

Kings County (N. Y.) Electric Light & Power Financing.—The directors of the Kings County (N. Y.) Electric Light & Power Company have authorized the issuance of $4,000,000 capital stock. When this is delivered to the holders of the $4,000,000 convertible debentures exchangeable at par for stock from March 1 next, there will be $14,000,000 stock outstanding. Through this conversion dividends will be increased by $320,000 and interest will be decreased by $240,000, making a net increase in charges of $80,000.

New Haven Company to Issue New Stock.—The stockholders of the United Illuminating Company, New Haven, Conn., have voted to authorize the directors to increase the capitalization of the company from $2,000,000 to $2,500,000. The present outstanding stock issue is $1,800,000. This will be increased to $2,100,000 by issuing $300,000 of new stock. The proceeds are to be used for improvements to the company's stations in New Haven and Bridgeport, Conn.

Cedar Rapids Manufacturing & Power Refunding Plan Approved.—The stockholders of the Cedar Rapids Manufacturing & Power Company, of Montreal, have approved the refunding plan to which reference was made in these columns last week. This provides for retiring the present authorized issue of $10,000,000 bonds and replacing these with a new issue of $15,000,000 first-mortgage forty-year 5 per cent bonds to be issued from time to time as required for the needs of the company.

Employees Strike in California Construction Camp.—More than 2000 of the men employed by Stone & Webster in constructing the hydroelectric developments for the Pacific Light & Power Company near Fresno, Cal., have gone on strike and, it is said, have seized the company's stores at their construction camp, 25 miles from that place. It is also reported that most of the men are members of the Industrial Workers of the World.

Anticipates a Good Year.—In a brief New Year's review published in a daily newspaper Mr. James W. Johnson, district manager in Chicago for the General Electric Company, said that he thought that the prospects for the year 1913, so far as the sale of electrical apparatus and supplies is concerned, would compare favorably with last year unless action by the new Congress on tariff revision affects general business unfavorably.

More Companies Added to West Penn System.—Effective Jan. 1, the Washington (Pa.) Electric Light & Power Company, the Canonsburg (Pa.) Electric Light, Heat & Power Company, the Citizens' Electric Light, Heat & Power Company, of McDonald, Pa., and the Waynesburg (Pa.) Electric Light & Power Company were merged with the West Penn Traction Company.

Southwestern Telegraph & Telephone Plans.—The Southwestern Telegraph & Telephone Company expects to spend about $4,500,000 in Texas this year in increasing its facilities. During the first ten months of 1912 the company spent about $40,000 on additional real estate and $2,500,000 on exchanges, including switchboards and other equipment, and about $700,000 on toll lines.

New England Telephone Earnings Increased in 1912.—Gross receipts of the New England Telephone Company in its fiscal year ended Dec. 31, 1912, were slightly in excess of $16,000,000, as compared with $14,705,448 in 1911 and $13,956,022 in 1910.

Standard Underground Cable Declares Extra Dividend.—The Standard Underground Cable Company has declared a quarterly dividend of 3 per cent and an extra dividend of 3 per cent. These were payable Jan. 10.

December Statement of Copper Producers' Association

The December statement of the Copper Producers' Association, issued Jan. 8, compares with the November statement as follows:

	December, pounds		November, pounds	
Stocks on hand in the United States on first of month		86,164,059		76,744,964
Production		143,354,042		134,695,440
		229,518,101		211,440,404
Domestic deliveries	58,491,723		69,369,795	
Foreign deliveries	65,713,796		55,906,550	
		124,205,519		125,276,345
Stocks on hand at end of month		105,312,582		86,164,059

Electric Securities

Q—Quarterly. M—Monthly. S—Semi-annually. A—Annually.

Security.	Outstanding.	DIVIDEND.		LAST QUOTATION.	
		Per Cent.	Period.	Bid	Asked
Adirondack Electric Power, c.	$9,500,000	.....	.....	19½	21
Adirondack Elec. Power, pf.	2,500,000	.....	.....	61½	63
Amer. Gas & Electric ($50), c.	2,500,000	1¾	Q	81	85
Amer. Gas & Electric ($50), pf.	1,537,500	1¾	Q	45	47
Amer. Light & Traction, c.	10,395,400	2½	Q	400	410
Amer. Light & Traction, pf.	14,236,200	2½	Q	108	110
Amer Power & Light, c.	5,631,400	.....	.....	66	68
Amer. Pwr. & Lt., 6% cum pf.	5,631,400	1½	Q	83	85
Amer. Pwr. & Lt., opt. warr.	1,604,000	.....	.....	13	15
Amer. Pwr. & Lt., 6% notes, '21	2,199,100	3	S	98½	100
Appalachian Power, c.	6,000,000	.....	.....	25	26
Appalachian Power, pf.	2,180,000	.....	.....	75	76½
Arizona Power, c.	3,000,000	.....	.....	12	13
Arizona Power, pf.	850,000	.....	.....	50	55
Asheville Light & Power, 1st s. f. 5s, '42	1,100,000	2½	S	93	96
Augusta-Aiken Railway & Electric, s. f. 5s, '35	2,588,000	2½	S	90	94
Augusta-Aiken Ry. & Elec., c.	2,250,000	.....	.....	23	25
Augusta-Aiken Ry. & Elec., pf	1,500,000	1½	Q	75	85
Augusta Railway & Electric, 1st 5s, '40	967,000	2½	S	100	....
Butte Elec. & Pwr., 1st 5s, '51.	4,283,000	2½	S	95	97½
Central Maine Power, 1st 5s.	2,502,000	5	A	97	99
Cities Service, c.	5,499,430	½	M	110	112
Cities Service, pf.	10,195,360	½	M	86½	87
Columbus Railway Gas & Electric, 1st 5s, '36.	2,454,000	2½	S	93	95
Columbus Ry., G. & Elec., c.	2,000,000	.....	.....	60	....
Columbus Ry., G. & Elec., pf.	840,000	1½	Q	85	95
Commonwealth Edison, cap. stock	32,964,800	7	A	145	....
Consolidated Gas, Electric & Power (Baltimore), 4½s.	11,564,000	2½	S	87	87¾
Consum. Pwr. (Mich.), 5s, '36.	10,088,000	2½	S	95½	97½
Consumers Power (Minn.), 1st 5s, '29	9,528,000	2½	S	89	92
Dallas Elec. Corp., 5s, '22	3,659,000	2½	S	95½	97½
Denver Gas & El. Lt., c.	7,001,300	¼	M	220	....
Denver Gas & El. Lt., gen 5s.	6,000,300	2½	S	93	95
Empire District Electric, 5s.	1,925,000	2½	S	84	86
Edison El. Ill. of Boston, cap. stock	15,603,700	2½	Q	239	....
Federal Light & Traction, c.	4,750,000	.....	.....	33	36
Federal Light & Traction, pf.	2,500,000	1½	Q	82½	85
Gas & Electric Securities, c.	1,000,000	.....	.....	135	150
Gas & Electric Securities, pf.	1,000,000	7	A	92	96
Harwood Electric, 5s, '39.	1,000,000	2½	S	100½	101½
Kings County El. Lt. & Pwr.	10,000,000	2	Q	140	....
Niagara Falls Power, 5s, '32.	10,000,000	2½	S	101½	102½
Northern Ohio Railway & Light, 4½s, '35	17,544,000	2¼	S	86	87½
Northern States Power, c.	5,975,000	.....	.....	23½	24½
Northern States Power, pf.	8,386,700	1¾	Q	84	86
Pacific Gas & Electric, c.	31,908,750	1¼	Q	62½	63
Pacific Gas & Electric, pf.	10,000,000	1½	Q	91½	91¾
Philadelphia Electric ($25).	24,987,750	1½	Q	22¾	....
Portland General Electric, 5s	8,000,000	2½	S	100	102
Republic Railway & Light, c.	5,200,000	.....	.....	24	27
Republic Railway & Light, pf.	6,360,000	1½	Q	79	81
St. Joseph's R., L., H. & P., 5s	4,637,000	2½	S	99	100
Seattle Electric Co., con. 5s, '29.	7,417,000	2½	S	97	97
Southern Calif. Edison, 5s, '39.	9,975,000	2½	S	96	98
Southern Power, 5s.	4,000,000	2½	S	99½	101
Standard Gas & Elec. ($50), c.	9,343,150	.....	.....	$21¼	$23
Standard G. & Elec. ($50), pf.	10,977,950	2	Q	$50	$51
Tennessee R., L. & Pwr., c.	20,000,000	.....	.....	22¾	24
Tennessee R., L. & Pwr., pf.	10,250,000	1½	Q	76½	77¼
Tri-City Railway & Light, c.	9,000,000	.....	.....	55	....
Tri-City Railway & Light, pf.	2,826,200	1½	Q	90	93
Tri-City Ry. & Lt., 5s, '23.	8,207,000	2½	S	97	98
Western Power	14,670,000	.....	.....	24	27
Western Power, 6% cum. pf.	6,000,000	6	A	51	53

Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent.	Period	Dec. 31	Jan. 8
Allis-Chalmers, 2d assess. paid	$17,151,100	.....	.....	1¼	1¼*
Allis-Chalmers, pf., 2d assess. paid	14,034,700	.....	.....	5	5*
Amalgamated Copper	153,887,900	1	Q	78½	77¼
American Tel. & Tel.	334,712,300	2	Q	139½	139½
Electric Storage Battery, c.	16,074,425	1	Q	53¼*	53¼
General Electric	77,726,700	2	Q	186	185
Mackay Cos., c.	41,380,400	1¼	Q	84*	84
Mackay Cos., pf.	50,000,000	1	Q	66¾*	68
Western Union Tel.	79,943,400	¾	Q	75¼*	75
Westinghouse, E. & M., c.	31,685,300	1	Q	79½*	78
Westinghouse, E. & M., pf.	3,998,700	1¾	Q	121½*	121½*

*Last price quoted.

NEW YORK METAL MARKET PRICES

	Dec. 30 Bid.	Dec. 30 Asked.	Jan. 7 Bid.	Jan. 7 Asked.
Copper:				
Standard, spot	17.00	17.37½	17.00	17.37½
	£ s d		£ s d	
London, standard, spot	76 5 0		76 7 6	
Prime Lake	17.65 to 17.75		17.65 to 17.75	
Electrolytic	17.55 to 17.65		17.55 to 17.65	
Casting	17.35 to 17.45		17.35 to 17.45	
Copper wire, base	19.00		19.00	
Lead	4.35		4.35	
Nickel	45.00		45.00	
Sheet zinc, f.o.b. smelter	9.00		9.00	
Spelter, spot	7.35		7.35	
Tin, spot	50.62½		50.20	
Aluminum:				
Prompt delivery	26.00 to 26.50		26.00 to 26.50	
Future	25.75 to 26.25		25.75 to 26.25	

OLD METALS

Heavy copper and wire	16.00	16.00
Brass, heavy	10.00	10.00
Brass, light	8.50	8.50
Lead, heavy	4.15	4.15
Zinc, scrap	6.12½	6.12½

COPPER EXPORTS IN JANUARY

Total tons to ..... Jan. 9, 3,159

Personal

Mr. A. A. Anderson has resigned as general manager of the Springfield (Ill.) Light, Heat & Power Company.

Mr. W. D. Matthews has been elected vice-president of the Canadian General Electric Company in place of the late H. P. Dwight.

Mr. J. R. McKee, chairman of the sales committee of the General Electric Company for a number of years, has been elected a vice-president of the company.

Mr. Clarence H. Mackay, president of the Postal Telegraph & Cable Company, has been elected president of the California Society of New York for 1913.

Mr. R. A. Ross, consulting engineer of Montreal, Que., has been engaged by the city of Calgary, Alberta, to report on the local power and lighting situation.

Mr. R. M. Searle, vice-president of the Rochester (N. Y.) Railway & Light Company, was elected president of the Chamber of Commerce of Rochester at its recent meeting.

Mr. Robert G. Griswold, for some time on the engineering staff of the Denver (Col.) Gas & Electric Light Company, has been transferred to the New York office of H. L. Doherty & Company.

Mr. S. N. Ford, president of the Mansfield (Ohio) Railway, Light & Power Company, was appointed receiver of the company on Dec. 30. The property was ordered to be sold within four months.

Mr. Charles O. Bancroft has resigned as president of the Cumberland County Power & Light Company of Portland, Maine, because of ill health, and Mr. W. M. Bradley has been elected to fill the vacancy.

Mr. Herbert Senger, assistant general manager of the Port Jervis (N. Y.) Light & Power Company, has resigned and joined the staff of the Consolidated Gas Purification & Chemical Company, New York.

Dr. G. W. Pierce, of the Department of Physics, Harvard University, on Jan. 4 addressed the New England Wireless Society in the Jefferson Physical Laboratory at Harvard on "Resonance in Receiving Circuits."

Mr. O. B. Young, a Boston attorney, formerly connected with Messrs. Stone & Webster, has been elected a vice-president of the General Electric Company to fill the vacancy left by the late Hinsdill Parsons.

Mr. Walter G. Clarke, consulting engineer, of New York, has been on the Pacific Coast during the last month investigating a number of important water-powers. He is expected to return to New York next week.

Mr. A. D. Furlong, formerly general superintendent and electrical engineer of the Springfield (Ill.) Light, Heat & Power Company, has been appointed general manager of the properties in place of Mr. A. A. Anderson, resigned.

Dr. Milton W. Franklin, who is in charge of the ozone laboratory of the General Electric Company at Schenectady, delivered an address on the production of ozone and oxygen at the Massachusetts Institute of Technology, Boston, Jan. 7.

Mr. C. S. Morgan, formerly manager of the new-business department of the Plattsburg (N. Y.) Gas & Electric Company, has been appointed general manager of the Lincoln (Ill.) Gas Company, succeeding Mr. H. S. Bramwell, resigned.

Mr. C. O. Poole, consulting engineer, of Los Angeles, Cal., recently underwent an operation for appendicitis. According to late reports he is now greatly improved in health, and the physicians express confidence in his ultimate recovery.

Mr. Sidney W. Ashe, of the General Electric Company, Harrison, N. J., delivered an illustrated lecture on "Some Fundamental Principles of Light Generation and Distribution" before the meeting of the Schenectady Section of the A. I. E. E. on Jan. 7.

Mr. T. I. Jones, general sales agent of the Edison Electric Illuminating Company of Brooklyn, is scheduled to deliver an illustrated address on the business of the Brooklyn Edison company before the Brooklyn Section of the N. E. L. A. on Jan. 13.

Mr. J. D. Maxwell has resigned as electrical engineer of the Spartanburg (S. C.) Railway, Gas & Electric Company to become connected with the Anderson Electric Carriage Company, which manufactures the "Detroit" electric vehicle. Mr. Maxwell will be attached to the Philadelphia office of the company.

Mr. Joseph M. Bricker has tendered his resignation as manager of the Somerset (Pa.) Electric Light, Heat & Power Company, effective Feb. 1. He will remain with the concern, however, as "secretary-treasurer," a position he has held since the organization of the company over twenty-one years ago.

Mr. M. Anderson has severed his connection with the Commonwealth Power Company of Jackson, Mich., and accepted the position of general manager of the People's Gas & Electric Company of Mason City, Ia., succeeding Mr. A. W. Zahm, whose resignation was announced in these columns on Nov. 16, 1912.

Mr. William H. Blood, Jr., past-president of the National Electric Light Association and of the Electric Vehicle Association of America, addressed the members of the Electrical Engineering Society of the Massachusetts Institute of Technology in Boston on Jan. 4. Mr. Blood's topic was "Suggestions for the Young Engineer."

Mr. C. S. Sergeant, vice-president of the Boston (Mass.) Elevated Railway Company, assumed the duties of head of the bureau of elevated and subway construction on Jan. 1, relinquishing the supervision of operation to Mr. Matthew C. Brush, second vice-president, and to Mr. C. H. Hile, who has been made chief of the bureau of maintenance.

Mr. P. P. Crafts, who for about eight years has been general manager of the Iowa & Illinois Railway Company, Clinton, Ia., has been made assistant to the chairman of the executive committee of interests which control the railway, electric and gas systems of a number of cities in Iowa, Illinois, Michigan, Indiana and Tennessee.

Mr. George Harvey Jones, of the Commonwealth Edison Company of Chicago, addressed the Electrical League of Southern California at its weekly luncheon at the Angelus Hotel, Los Angeles, on Dec. 31. His topic was "The Power Engineer and His Work."

Mr. Wallace P. Mercer, manager of the Delphos (Ohio) Electric Light & Power Company and of the Van Wert (Ohio) Public Service Company, will in future also have general supervision over a number of stations in various states controlled by the same financial interests. Mr. Mercer will take over part of the work of President E. W. Lathrop.

Mr. W. J. Canada, engineer of the Rocky Mountain Fire Underwriters' Association, was presented with a C. L. Guinand stop-watch for use in fire-engine and pump tests by the Commissioners of the city of Pueblo, Col., at a recent meeting. The gift was in appreciation of Mr. Canada's services as chairman, without compensation, of the Pueblo Board of Electrical Engineer Examiners.

Mr. L. A. McArthur, assistant general manager of the Pacific Power & Light Company, Portland, Ore., was awarded a prize of $25 in gold for the best popular name for the Portland, Eugene & Eastern Railway Company, which is constructing 340 miles of electric interurban transportation lines through the Willamette Valley. The name "Web-foot Route" has been officially adopted by the company.

Mr. H. W. Fuller, whose transfer from Bluefield, W. Va., to Louisville, Ky., was announced in these columns on Dec. 7, at a recent meeting of the directorate of the Louisville (Ky.) Gas Company and its subsidiary, the Louisville Lighting Company, was elected to the office of vice-president in both utilities. Mr. Fuller will act as chief aide to General George H. Harries, president of the two corporations.

Mr. W. P. Naser, formerly manager of the electrical departments of the H. W. Johns-Manville Company's New Orleans and Texas branches, has resigned and accepted the post of sales manager of the Cravens Electric Company, Chicago. Prior to his connection with the H. W. Johns-Manville Company, Mr. Naser was employed in the British and American works of the Westinghouse Electric & Manufacturing Company.

Mr. James W. Dunbar, of New Albany, Ind., has been made general manager of the United Gas & Electric Company of that city, succeeding Mr. Martin J. Insull, of Chicago, who, however, retains the management of the railway and interurban systems. Mr. Dunbar was secretary of the Western Gas Association for a number of years during his position as superintendent of the old gas, light and coke company of New Albany.

Mr. R. G. Bonner, manager of the Louisville (Ky.) branch of the Westinghouse Electric & Manufacturing Company, has resigned his position, to become new-business manager of the electric utility in Elyria, Ohio, owned by Henry L. Doherty & Company. Mr. Bonner is well known in the Ohio Valley electrical field, having been connected with the Westinghouse interests in that section for a number of years. He is succeeded by Mr. J. C. McClendon, who has been his assistant for about one year.

Mr. H. C. Alvord, formerly manager of the new-business department of the Metropolitan Electric Company of Reading, Pa., has severed his connection with the company to accept the position of manager of the Keystone Electric Company, a local electrical contracting concern. Mr. Alvord was formerly in the employ of the New York & Queens Electric Light & Power Company, the Edison Electric Illuminating Company of Brooklyn, and the Montreal Light, Heat & Power Company.

Mr. C. O. Mailloux, who is now visiting Europe in his official capacity as president of the United States committee of the International Electrotechnical Commission and vice-president on international arrangements for the International Electrical Congress at San Francisco in 1915, was the moving spirit in the founding of the *Electrical World* in 1883 and served as its first editor. He was a charter member of the American Institute of Electrical Engineers, having signed the "call" for its organization in 1883. Mr.

Mailloux has always maintained an active interest in the Institute and has been elected a manager three times and a vice-president twice. He served as a delegate of the Institute to the congress in Paris in 1900, London in 1906, Marseilles in 1908 and Turin in 1911.

Mr. E. G. Connette, since May, 1912, vice-president of the International Railway Company, Buffalo, N. Y., has been elected president of the company to succeed Mr. Thomas Penny, resigned. Prior to his election as vice-president of the International Railway Company, Mr. Connette was transportation engineer for the Public Service Commission of the First District of New York. He is well known in electric railway circles and has taken an active part in the affairs of the national and state railway associations.

Mr. A. Hussey, who for the past six years has been in charge of construction and maintenance of all transmission facilities for the New York Central & Hudson River Railroad, electrical division, New York, has been appointed acting superintendent of distribution of the Edison Electric Illuminating Company of Brooklyn as successor to Mr. J. W. Lafferty, whose resignation was announced in these columns Dec. 14. Prior to his connection with the New York Central, Mr. Hussey was with the Cataract Power & Conduit Company of Buffalo, N. Y., where he served eight years.

Mr. Hugo Reisinger, of New York, the well-known importer of arc-lamp electrodes, has been appointed privy counselor to the Prince Regent of Bavaria, who in 1910 also decorated him with the Star of the Commander's Cross of the Order of St. Michael. This latter honor was conferred on Mr. Reisinger for his work in promoting art exhibitions in Germany and the United States. Mr. Reisinger is a patron of art and possesses one of the finest collections of modern paintings in the country. He is an honorary fellow for life of the New York Museum of Art and the Copley Society of Boston. Columbia University conferred on him the honorary degree of master of arts in 1911.

Mr. Joseph D. Evans, whose appointment as construction manager of the Electric Bond & Share Company, New York, was noted in the *Electrical World* Jan. 4, 1913, was educated at the schools of Lowell, Mass., where he was born, and was graduated as a civil engineer from the Massachusetts Institute of Technology. He went south to do work in the engineering department of the proposed Nicaraguan canal and was subsequently associated with the United States government engineers in the preparation of the original estimates for the Panama Canal. He next engaged in steam-railway construction in the republic of Ecuador. After this Mr. Evans engaged in electric railway work in Pennsylvania, Massachusetts and Connecticut and a little later was appointed general superintendent of construction of the Great Northern Power Company at Duluth, Minn. Subsequently he represented J. G. White & Company in the construction of the Buffalo, Lockport & Rochester Railway, which operates an electric railway between Rochester and Lockport. He was then appointed by J. G. White & Company resident engineer of the Canadian Light & Power Company, and on the completion of the plant at St. Timothée he accepted the position of chief engineer of the Montreal Tramways. Mr. Evans will have charge of plants under construction in Utah and Idaho by the Electric Bond & Share Company.

Mr. Frederic Nicholls, who has held the most prominent place in Canadian electrical manufacturing for many decades, has been elected president of the Canadian General Electric Company, succeeding Mr. W. R. Brock, who has been made honorary president and chairman of the board. Mr. Nicholls was born in England on Nov. 23, 1856. He received his education at Stuttgart and in 1874 crossed the Atlantic for Canada. His early connection with Dominion politics and journalism are matters of Canadian history. In the electrical world he is best known as an active pioneer whose faith in electricity and its application in Canada is unbounded. His was the moving spirit in the organization of the first incandescent lighting system in Canada, and his was the domineering personality which maintained the Canadian General Electric Company as one of the most independent and influential of the electrical manufacturing companies in the Dominion. He was keenly interested in the promotion of the first street railway system and in the first interurban railway system of the Dominion. To him also belongs the credit for the building of the hydroelectric system of the Electrical Development Company of Ontario, Ltd., at Niagara Falls, Ont., and the 85-mile transmission line to Toronto. Until recently, when he began gradually to curtail his numerous responsibilities in order to conserve his energies in the interests of purely Canadian work, Mr. Nicholls was associated with other Canadians in the Brazilian utilities at Sao Paulo and Rio de Janeiro. Mr. Nicholls was president of the National Electric Light Association in 1896-7.

Mr. Walter Farrington Wells has been appointed general manager of the Edison Electric Illuminating Company of Brooklyn as successor to Mr. W. W. Freeman, who resigned some time ago to become vice-president and general manager of the Alabama Interstate Power Company, Birmingham, Ala. Mr. Wells, who is well known in the industry, was born in Rahway, N. J., Jan. 10, 1870, and received his technical education at Rutgers College. After leaving college he became associated with the Brooklyn Edison company, occupying successively positions as draftsman, foreman and assistant electrician and in June, 1894, was appointed electrical superintendent. In April, 1897, he accepted the position of assistant general manager of the then Manhattan Electric Light Company with full charge of technical departments. This position he held until 1900, when the company was merged with the New York Edison Company, and he then was made a district superintendent. In June, 1899, he was appointed superintendent of the old Mount Morris Electric Light Company and continued to act as such for about a year. When the Edison company made its first installation of rotary converters, etc., for 6600-volt transmission the direction of the work was assigned to Mr. Wells and he also co-operated in the preparation of the plans and superintended the installation of the electrical plant of Waterside Station No. 1. When the station was completed Mr. Wells was appointed superintendent in general charge of its operation. Upon the death of Mr. E. A. Leslie, vice-president and general manager of the Edison Electric Illuminating Company of Brooklyn, the position of general superintendent was created and Mr. Wells was appointed to discharge its duties. Mr. Wells held this position until recently, when he was appointed acting general manager and finally general manager. Mr. Wells has contributed several papers on subjects connected with the operation of large generating systems to the transactions of the Association of Edison Illuminating Companies and to the National Electric Light Association. He is a fellow of the American Institute of Electrical Engineers and of its power station committee. He is also general chairman of the technical committee of the National Electric Light Association and chairman of the committee on steam turbines of the Association of Edison Illuminating Companies.

WALTER F. WELLS

Obituary

Mr. John J. Lowthaire, a salesman connected with the foreign department of the General Electric Company, 30 Church Street, New York City, dropped dead in his office on Dec. 28. Mr. Lowthaire was married and lived with his wife and one child in Richmond Hill, L. I.

Samuel Barclay Charters, Jr., assistant professor of electrical engineering at Leland Stanford Junior University, died at the home of his father in Pittsburgh, Pa., Dec. 29. Mr. Charters represented the city of Los Angeles on the commission having in charge the construction of the municipal aqueduct and power plants. A wife and son survive him.

Construction

FAYETTEVILLE, ARK.—The property of the Fayetteville Pwr. & El. Co. has been purchased by W. R. Felker, of Rogers, who, it is understood, represents Kansas City interests. The consideration is said to have been $135,000.

HELENA, ARK.—The installation of an ornamental street-lighting system in the business district is under consideration.

CORNING, CAL.—The Sacramento Valley El. Ry. Co. contemplates extending its railway to Paskenta, a distance of 24 miles.

ESCONDIDO, CAL.—The Escondido Lt. & Pwr. Co. has applied to the State Railroad Commission for authority to issue and sell at par 49,500 shares of capital stock, the proceeds to be used for the construction of a hydroelectric power plant.

HOLTVILLE, CAL.—The Holton Pwr. Co. contemplates improvements and extensions to its system, for which bonds to the amount of $150,000 have been issued.

LOS ANGELES, CAL.—Bids will be received until Jan. 31 by the Board of Public Works for 253 steel towers for 110,000-volt transmission line. Forms, etc., may be obtained on application to the Los Angeles Aqueduct Board.

MADERA, CAL.—J. S. Harker, president of the Mountain Progressive Club, is promoting the construction of an electric railway from Madera to Yosemite Valley. To secure power for the proposed railway it is proposed to store the waste waters of the North Fork watersheds to be utilized to drive a hydroelectric power plant.

POMONA, CAL.—The City Council has passed an ordinance providing for extending the electric-lighting system on several streets. The street-lighting service is furnished by the Southern California Edison Co. Frank Balfour is local manager.

REDLANDS, CAL.—Bids will be received by R. Warner Thomas, City Clerk, until Feb. 5 for construction of an electric power plant for the municipal water system. The plant will require a maximum of 600 hp; bids to be taken on steam, gasoline and crude-oil engines. F. E. Trask, Union Oil Building, Los Angeles, is consulting engineer.

SACRAMENTO, CAL.—The residents of South Oak Park are preparing a petition to present to the City Commissioners asking for the installation of arc lamps on Palmetto Avenue.

SACRAMENTO, CAL.—Bids will be received by E. F. Pfund, County Clerk, at the office of the Board of County Supervisors, 910 Sixth Street, Sacramento, until Jan. 21 for furnishing and installing lighting fixtures in the Court House Building in Sacramento, in accordance with the amended plans and specifications prepared by R. A. Herald, architect, which may be seen at the office of the architect, 430 Forum Building, Sacramento.

SAN DIEGO, CAL.—Bonds to the amount of $35,000 have been voted by the San Ysidro Irrigation District, comprising the Little Landers Colony, the proceeds to be used for the installation of a new electric pumping plant and about 4 miles of steel, iron and concrete pipe.

SAN LUIS OBISPO, CAL.—The Coalinga Wtr. & El. Co., of Coalinga, has applied to the State Railroad Commission for permission to construct and operate an electric light and power system in San Luis Obispo, Monterey and Santa Barbara Counties.

SIERRAVILLE, CAL.—The Mountain Development Co. is preparing to install a 2500-hp hydroelectric power plant on Berry Creek, near Sattley. The plans call for the construction of several dams near the head waters of Berry Creek to conserve the annual flood waters for power purposes. The power generated at the plant will be used for pumping water for irrigation purposes. W. O. Peck is interested in the project.

STOCKTON, CAL.—The City Council has accepted the bid of the Western States Gas & El. Co. for lighting the streets of the city with 475 arc lamps.

STOCKTON, CAL.—The Oro El. Corpn., of Oroville, has been granted a 50-year franchise to operate in Stockton. The company has obtained 3500 applications for service in the city limits of Stockton and will now apply to the State Railroad Commission for permission to build and operate distributing systems in and around Stockton.

WILMINGTON, CAL.—The Pacific El. Ry. Co., of Los Angeles, is planning to build local car lines to some of the harbor tracts recently put on the market.

YREKA, CAL.—The California-Oregon Pwr. Co. is canvassing the ranchers living between its substation on the Bryant Ranch in Scott Valley and Callahan, a distance of about 14 miles, for the purpose of securing subscribers to take electricity for lamps and motors. If sufficient patronage is secured a transmission line will be erected to supply electricity in that district.

DELTA, COL.—Negotiations have been completed for the sale of the Delta El. Lt. & Pwr. Co. to the Utah Pwr. & Lt. Co. for $75,000. The absorption of the Delta plant is the first step in the efforts of the Colorado-Utah Pwr. Co. to establish a continuous chain of power plants on the western slope from Telluride to Grand Junction. It is understood that options will soon be made on plants at Montrose and Ouray. Energy for operating the local system will be supplied from the central station in Telluride and a 24-hour service will be established. J. E. Shue, manager of the local plant, will be retained.

NEW HAVEN, CONN.—The Connecticut Co. contemplates extensions to its system in Norwalk, South Norwalk, New Britain, Berlin and Ansonia for which franchises will be asked; also construction of a line from Bridgeport to Nichols. The company asks for a revival of rights to build northward from Milford to the tracks of the New Haven & Derby Railroad.

NEW MILFORD, CONN.—The property of the New Milford El. Lt. Co. has been purchased by a company, recently organized, which proposes to erect a large mill here. Energy generated by the plant will be used to operate the new mill. The new company has announced that it will continue to furnish electrical service to the town but will secure electricity from the Bulls Bridge plant, north of the village, serving it through a local substation to be erected.

WASHINGTON, D. C.—A report from an American consular officer states that a foreign firm some time ago was granted a concession for the distribution of electrical power for various purposes. The power plants and repair shops are now under construction and the company is now in the market for power-house machinery, steel cables, wire, batteries, generators, electric meters, glass insulators, tools and implements of all kinds, as well as all sorts of electrical appliances, such as stoves, irons, chandeliers, etc. For further information address No. 10,138, Bureau of Manufactures, Department of Commerce and Labor.

WASHINGTON, D. C.—Proposals will be received at the office of the Chief Signal Officer, War Department, Washington, D. C., until Jan. 20 for the following supplies: Item 1—15,560 feet cable, type 215; (2) 1200 ft. 150-pair, paper-insulated, lead-sheathed and armored cable; (3) 5000 ft. phosphor-bronze antenna cord; (4) 10,000 ft. cable, type 214; (5) 3000 ft. cable, type 308; (6) 10,000 ft. cable, type 401; (7) 2000 ft . cable, type 408; (8) 30,000 ft. outside distributing wire, 45 mils; (9) 45,000 ft. pothead wire, 36 mils; (10) 25,000 ft. single bridle wire, 51 mils; (11) 3000 ft. cable, type 321; (12) 2000 ft. cable, type 324; (13) 50,000 ft. one-pair, rubber-insulated, lead-sheathed, galvanized, flexible armor, Greenfield type of Sprague Electric Works (type 251) cable. Further information may be obtained on application to W. L. Clarke, captain Signal Corps, U. S. A., Washington, D. C.

ST. AUGUSTINE, FLA.—Arrangements are being made to incorporate the Jacksonville & St. Augustine Public Service Co. for the purpose of building a power plant to furnish electricity for lamps, heaters and motors. It is proposed to manufacture byproducts from the use of yellow pine as fuel, including tar, charcoal and pine oil, etc. The company will be capitalized at $2,000,000. William F. Ellis, of Chicago, Ill., is consulting engineer; A. W. Corbett, president; John D. Andreu, vice-president; D. L. Dunham, secretary, and A. E. Baya, treasurer.

ROME, GA.—The City Council has engaged Solomon & Norcross, consulting engineers, of Atlanta, to prepare plans and estimates of the cost of establishing a municipal electric light and power plant.

BRUNEAU, IDAHO.—The Great Shoshone & Twin Falls Wtr. wr. Co., of Twin Falls, contemplates building a power plant in Bruneau. It is understood that work will start at once.

AMBOY, ILL.—The City Council has entered into a contract with the Illinois Northern Utilities Co. by the terms of which 17 ornamental standards, carrying three-lamp clusters, will be erected on the principal streets and carbon filament lamps in the residential district will be replaced by tungsten lamps attached to goose-neck posts 11 feet high.

ASHMORE, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has decided to erect a power plant in Ashmore. The plant when completed will furnish electricity in Ashmore, Oakland and Westfield.

BLOOMINGTON, ILL.—Superintendent S. S. Noble, of the municipal electric light plant and water-works pumping station, has recommended to the City Council the purchase of a 200-kw electric generator for the electric light plant.

BUSHNELL, ILL.—A committee composed of John M. Brant, M. N. Pinckly, George W. Cole, C. S. Norcoss and C. C. Chain has been appointed by the business men to make investigations and report upon the feasibility of establishing an electric light plant. The Central Illinois Pub. Serv. Co., of Mattoon, is asking for a 50-year franchise.

CENTRALIA, ILL.—Application has been made to the City Council by G. L. Pittenger, C. E. Stead, Dwight F. Haussler and associates, who propose to organize the East Side El. Ry. Co., for a 20-year franchise to construct and operate an electric railway on Locust Street, Saline Street and Wabash Avenue.

CLINTON, ILL.—The Board of Local Improvements is considering plans for the installation of an ornamental street-lighting system on East Washington, North Centre, East Main, East Adams, North Monroe and South Madison Streets.

DELAVAN, ILL.—The Royal Lt. & Pwr. Co. has been awarded a contract by the city to furnish electricity for the municipal water-works system, beginning May 1, at $1,680 per year. The company was also awarded the contract for lighting the streets and parks of the city.

FRANKLIN, ILL.—The Village Board has granted the Central Illinois Public Service Co. a franchise to operate an electric light system here for a period of 50 years.

FREEPORT, ILL.—The City Council contemplates the installation of a fire signal system, to cost about $4,000.

JERSEYVILLE, ILL.—Steps have been taken to organize a new electric-light company. Judge H. W. Pogue and others are interested in the project.

LINCOLN, ILL.—The Board of Supervisors of Logan County has voted an appropriation of $1,350 for the purpose of installing sixteen ornamental lamps about the square. The city agrees to furnish electricity and maintain the lamps for 15 years. Merchants have agreed to erect similar lamps on opposite side of the four streets.

OHIO, ILL.—The Illinois Northern Utilities Co. of Chicago is reported to have purchased the property of the Ohio El. Co.

PEORIA, ILL.—The residents of Hamilton Boulevard have started a project for the installation of an ornamental lighting system on that thoroughfare.

PEORIA, ILL.—The Peoria Gas & El. Co. has absorbed the electric plants at Roanoke, Eureka and Metamore, Ill., owned by the Eureka Electric System, and has assumed control of same.

ROCKFORD, ILL.—Business men on Fourteenth Avenue have decided to hold a meeting to interest property holders in a project for installing an ornamental lighting system on that thoroughfare.

SHEFFIELD, ILL.—The Kewanee El. Lt. & Pwr. Co., of Kewanee, is said to be negotiating for the purchase of the local plant owned by the Sheffield El. Lt. Co. The Kewanee company is asking for a 25-year franchise in Sheffield.

SPRINGFIELD, ILL.—The extension of the ornamental street lighting to several more streets is under consideration. Willis J. Spaulding is City Commissioner.

SPRING VALLEY, ILL.—Arrangements are being made for lighting the 3-mile strip of country road between Cherry and Arlington, and if the experiment is successful, it is expected that the road from Cherry to Ladd will be lighted in the same manner. A contract is now pending between the Commissioners of Westfield Township and the Spring Valley Gas & El. Co. for lighting the road between Cherry and Arlington.

STERLING, ILL.—The Illinois Northern Utilities Co., of Chicago, is reported to have offered $75,000 for the Griswold wire plant, which has excellent water-power facilities. The wire company is in the hands of a receiver.

WALNUT, ILL.—The Illinois Northern Utilities Co., of Chicago, Ill., is reported to have purchased the local electric-light plant.

WAVERLY, ILL.—The local electric light plant, owned by H. J. Rodgers, has been purchased by the Central Illinois Pub. Serv. Co., of Mattoon, Ill.

WYOMING, ILL.—The Ideal Club is raising funds to install ornamental lamps in Central Park.

EVANSVILLE, IND.—The Evansville Gas & El. Lt. Co. and the Evansville Public Ser. Co. have consolidated under the name of the Evansville Pub. Ser. Co. The new company is capitalized at $1,350,000, and the directors are B. C. Cobb, W. H. Barthold, A. C. Blinn, F. J. Haas, F. W. Cook, S. W. Cook and Henry Marshall.

INDIANAPOLIS, IND.—The Terre Haute, Indianapolis & Eastern Trac. Co. is reported to have contracted with the Vandalia Coal Co., the Coal Bluff Mining Co. and the Western Indiana Mining Co. to supply electrical energy for mining purposes, to be supplied by transmission lines for which the company has secured franchises over most of the public highways in Vigo County.

MARION IND.—The Marion Lt. & Htg. Co., of Marion, the Jonesboro Lt. & Wtr. Co., of Jonesboro, and the Upland El. Co. have been consolidated and will be known as the Marion Ltg. & Htg. Co. The new company is capitalized at $1,600,000, and will furnish electricity for lamps and motors and steam heat in the towns and cities named. The directors are H. L. Finley, F. P. Hunter and M. B. Smythe.

MIDDLEBURY, IND.—Pidgeon Brothers are contemplating the installation of an electric-light plant in connection with their flour mill. The generating equipment will be driven by two Curtiss waterwheels, one 25 in. and the other 35 in., which now are used to operate the flour and feed mill. Three-phase, 60-cycle system will be used, but generating machinery has not yet been decided upon. Work will begin on the proposed work early in the spring.

MONTICELLO, IND.—The capital stock of the Monticello Tel. Co. has been increased from $30,000 to $60,000.

SOUTH BEND, IND.—The Indiana & Michigan El. Co. has increased its capital stock to $3,500,000. The company proposes to make extensive improvements to its plant.

WALKERTON, IND.—The Board of Trustees of the municipal electric-light plant expects to purchase two boilers and an engine and alternator for the municipal electric plant in the spring. A. L. Freyer is superintendent.

DALLAS, IA.—The Consolidated Coal Co., 139 West Van Buren Street, Chicago, Ill., is preparing plans for the construction of an electric power plant, about 2 miles south of Dallas, to supply electricity to operate a coal mine. The equipment, contracts for which have been let, will include two 300-hp Oil City water-tube boilers, two stokers, manufactured by the Illinois Stoker Co., coal-conveying equipment, made by the Webster Mfg. Co., one 600-kw General Electric steam turbine, one 1600-kw General Electric 2300-volt, 60-cycle alternating-current generator and three 25-kw General Electric transformers. Carl Scholz, of Chicago, Ill., is vice-president of the company and P. P. Reecs, of Dallas, Ia., is engineer in charge of the work.

MARCUS, IA.—K. C. Gaynor, of Sioux City, recently granted a franchise, will install an electric-light plant in Marcus. The equipment will include a 35-kw alternating-current generator, 12 transformers, 200 poles and 100 meters. A complete stock of electrical supplies will be carried.

MUSCATINE, IA.—The City Council is considering plans submitted by B. C. Blackwell for substituting electric lamps for gas lamps and extending the arc-lamp lighting district.

WEBSTER CITY, IA.—Arrangements are being made to install an ornamental street lighting system in the business district, for which funds have been subscribed by the merchants. R. J. Mullins is superintendent of the municipal electric plant.

BLUE MOUND, KAN.—A special election has been called for Jan. 20 to vote on the proposition of issuing $6,000 in bonds, the proceeds to be used to take over the property of the Blue Mound El. Lt. Co. and to enlarge and improve the same. If the proposition carries, improvements will be made to the plant and street-lighting system and a 24-hour service established.

CANTON, KAN.—The city of Canton is planning to install an electric-light plant to cost from $10,000 to $12,000. A storage-battery system is being considered. As yet no contracts have been awarded. The city has not yet engaged an engineer. T. N. Frantz is city clerk.

CEDAR POINT, KAN.—C. B. Avis, city clerk, writes that an election will probably not be held before spring to vote on the proposition to issue bonds for the installation of an electric-light plant.

DE SOTO, KAN.—Plans are being considered for the construction of a municipal electric-light plant, to cost about $4,500. Bids will soon be received for construction of plant. Jerome Runyon, of De Soto, is engineer in charge.

HORTON, KAN.—The city is contemplating the purchase of General Electric transformers, wire and meters for the municipal electric-light plant. W. W. Wood is superintendent.

SCOTT, KAN.—At an election held Dec. 31 the proposition to issue bonds for $40,000 for construction of an electric-light plant and waterworks system was carried. O. D. Card is city clerk.

HARDINSBURG, KY.—Preparations are being made by William T. Halliday, of Chicago, Ill., for the installation of an electric light plant here. Application has been made for a franchise.

WINCHESTER, KY.—An agreement has practically been reached between the City Council and the Winchester Ry., Lt. & Ice Co. for the renewal of the street-lighting contract. Under the agreement the company is to replace the present arc lamps (17 in number) with 400-cp tungsten lamps and to install 10 additional lamps of 100 cp; also to furnish electricity for lighting the city hall and pumping station free of charge.

FRANKLINTON, LA.—The Franklinton El. Lt. & Pwr. Co. is rebuilding its plant recently destroyed by fire. Contracts for machinery have been let and it is expected to have the plant in operation by Feb. 1. M. M. Magee is president.

ANNAPOLIS, MD.—The Annapolis Public Utilities Co., recently incorporated, has entered into a contract with the Washington, Baltimore & Annapolis El. Ry. Co. for energy for street and residential lighting in the city of Annapolis. Contracts have already been awarded for transformers, etc. It is understood that the Annapolis company proposes to erect a gas plant here.

GARDNER, MASS.—The Selectmen have granted the Gardner Electric Light Company permission to lay underground wires on Pearl Street from Green to James Street.

NEW BEDFORD, MASS.—The Board of Aldermen has refused to grant the Southern Massachusetts Pwr. Co., of Fall River, a franchise to supply electricity in New Bedford.

ANN ARBOR, MICH.—The contract for construction of the power, heating and lighting plant for the University of Michigan has been awarded to James Stewart & Co., of Chicago. Shirley W. Smith is secretary of the university.

DETROIT, MICH.—The Banner Laundering Co. has purchased a 130-kw generator from the Crocker-Wheeler Co. and is planning to install additional equipment in its plant.

DETROIT, MICH.—The Acme White Lead & Color Works have made arrangements to secure part of their power from the Detroit Edison Co. They will continue to use steam and gas engines.

FORD CITY, MICH.—The Eastern Michigan Edison Co. is making an appraisal of the electric-light equipment in Ford City with a view of purchasing same and furnishing electricity here. Electrical service is now supplied from the plant of the Michigan Alkali Co. Post office address is Wyandotte, Mich.

IRONWOOD, MICH.—The Ironwood & Bessemer Ry. & El. Lt. Co. has increased its capital stock from $700,000 to $900,000.

SAGINAW, MICH.—The Michigan State Tel. Co. contemplates extensive improvements to its system in Saginaw during 1913, which will involve an expenditure of about $195,000. The plans provide for an addition to its present office building and extensions to the underground conduit system, also to lay two and perhaps three more cables across the river to take care of the West Side business.

BOYD, MINN.—We are informed that bids will be received until Jan. 22 for the installation of a municipal electric-light plant in Boyd. Earl D. Jackson, Capital Bank Building, St. Paul, is consulting engineer.

HASTINGS, MINN.—Proposals will be received by the State Board of

Control, State Capitol Building, St. Paul, Minn., until Jan. 14 for the electric feeders for the State Asylum for the Insane at Hastings, in accordance with plans and specifications prepared by Charles L. Pillsbury, engineer, 805 Metropolitan Life Building, Minneapolis, Minn. Copies of plans and specifications may be seen at the office of the superintendent, State Asylum, Hastings; Builders' Exchange at St. Paul and Minneapolis and at the office of the State Board of Control and at the office of the engineer.

MINNEAPOLIS, MINN.—The City Council has granted the Minneapolis General Electric Co. permission to extend its 13,000-volt transmission line to the suburbs, St. Louis Park, Hopkins and Excelsior.

MONTICELLO, MINN.—Preparations are being made by the Monticello El. Lt. & Pwr. Co. to begin work on its proposed electric-light plant. Ornamental standards carrying three-lamp clusters are to be used for street lighting.

NEW PRAGUE, MINN.—The city of New Prague expects to purchase within the next 10 months one fire-tube, high-pressure boiler, a 40-kw, 250-volt direct-current directly connected unit (steam driven) and 400 incandescent lamps; also within the next 12 months about 400 lb. of wire. Joseph T. Rynda is superintendent.

PORTER, MINN.—The Village Council has granted the Citizens' Lt., Ht. & Pwr. Co. a franchise to install and operate transmission lines for the distribution of electricity for lamps and motors in Porter for a period of 25 years.

RICH HILL, MO.—The cost of the proposed municipal electric-light plant is estimated at about $15,000. Bids for construction of plant will be received about June 15. Rollins & Westover, Midland Building, Kansas City, Mo., are engineers.

SEDALIA, MO.—The Sedalia Lt. & Trac. Co., it is stated, contemplates improvements to its system, including the installation of a 500-kw turbine, rebuilding all lines and making other extensions, rebuilding two ice plants, building ice-storage rooms, increasing capacity of gas plant 50 per cent, general rebuilding and extending all gas mains, together with several new lines on traction system.

GLASGOW, MONT.—The light commission contemplates the purchase of one 65-kw, 60-cycle, three-phase alternating-current generator, directly connected, and a condensing outfit for the municipal electric-light plant within the next 12 months. A. J. Melvin is superintendent.

TWIN BRIDGES, MONT.—The Waters Tunnel Co. is contemplating the construction of an electric line from a point on the Northern Pacific Railway between Sheridan and Lauri to its mines located in Tobacco Root Range.

KEARNEY, NEB.—Mayor Patterson has vetoed the ordinance granting the Kearney Lt. & Pwr. Co. a ten-year contract for lighting the city, which was upheld by the Council.

WEST POINT, NEB.—W. T. S. Neligh, of West Point, has been granted water rights on the Elkhorn River for a 1500-hp hydroelectric power plant.

DEMING, N. M.—The plant and holdings of the Deming Land & Pwr. Co. have been purchased by C. E. Miesee, of Chicago, Ill., and associates. Included in the deal is a contract for the development of 9500 acres of state land situated 10 miles east of Deming, which will involve an expenditure of approximately $1,000,000. Wells will be bored upon the land and pumping plants installed. The company contemplates installing a central power plant upon the land and erecting transmission lines from the plant over the property. A town will also be established on the tract.

ALBANY, N. Y.—Sealed proposals will be received by Duncan W. Peck, Superintendent of Public Works, Capitol, Albany, until Feb. 4, for improving the New York State canals as follows: Contract No. 92, Erie Canal, sections 1 to 4; Champlain Canal, sections 1 to 2. For power plants, electrical equipment and machinery for operating and lighting locks and guard gate as follows: Erie Canal—locks 2 to 19, inclusive; Champlain Canal—locks 1 to 8, inclusive, and guard gate, station 293+70; Erie Canal—sheets 1 to 107, inclusive. Contract No. 94, Erie Canal—sections 8 to 11. Power plants, electrical equipment and machinery for operating and lighting locks as follows: Erie Canal—locks 26, 27, 28A, 28B, 29, 30, 32, 33, 34, 35; guard lock, station 2413+42, and guard lock, station 2468+48, near the Genesee River, sheets 1 to 45, inclusive. Plans may be seen and detailed specifications, engineers' estimate of quantities, proposal blanks, form of contract and other information may be secured at the office of the Superintendent of Public Works, Albany; at the office of the Assistant Superintendent of Public Works for the Middle Division, Syracuse; at the office of the Assistant Superintendent of Public Works for the Western Division, Rochester, and at the canal office, Spaulding's Exchange, Buffalo. Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany upon payment to him of the cost of producing them.

BINGHAMTON, N. Y.—The City Council has engaged Douglas Sprague, 39 Cortlandt Street, New York, consulting engineer, to take charge of the construction of the proposed municipal electric-light plant, to cost about $158,200.

CASTLETON, N. Y.—The Schodack Lt. & Pwr. Co., which recently purchased the local electric-light plant, has awarded contract for construction of plant to Frost & Shelden, Albany. The equipment will include steam engine, Crocker-Wheeler generator and six transformers, 4 miles of wires and chestnut poles to carry same, 75 meters and 65 incandescent lamps. L. M. Lansing is superintendent.

NEW YORK, N. Y.—The contract for installing electric equipment in new Public School 175, Borough of Brooklyn, has been awarded to T. Frederick Jackson (Inc.) for $10,369.

NIAGARA FALLS, N. Y.—Now that the Buffalo-Niagara Falls Boulevard is completed the local boulevard commission will make an attempt to secure an appropriation from the State Legislature to have the highway between the Niagara Falls city line and the Buffalo city line illuminated by electricity. The cities of Niagara Falls and Buffalo will be asked to light that part of the highway within their limits. It is proposed to use ornamental lamp standards.

OCEAN BEACH, N. Y.—A company is being formed under the name of the Ocean Beach-Fire Island Public Service Corpn. for the purpose of providing electric-light and water service. It is expected to have the plant in operation by May 1.

OVID, N. Y.—The Ovid El. Co. has applied to the Public Service Commission, Second District, for permission to increase its capital stock from $10,000 to $25,000 and for authority to execute a mortgage of $50,000 and to issue $45,000 in bonds, the proceeds to be used for new construction and for refunding outstanding obligations. The company proposes to increase its water-power plant at Taughannock Creek and to improve and extend its service. The company leases the plant of the Trumansburg Ltg. Co. and has petitioned for permission to consolidate the two companies. The company proposes to build a new dam and an auxiliary steam power plant to be operated in connection with the water-power plant at the creek.

PLEASANT VALLEY, N. Y.—The Village and Town Boards of Pleasant Valley have granted the Central Hudson Gas & El. Co., of Poughkeepsie, permission to erect transmission lines through the village and town as far as the town line of Washington. It is expected that the latter town, also Millbrook and Pleasant Valley, will have electrical service within a few months.

WHITE PLAINS, N. Y.—The Board of Village Trustees is considering the question of establishing a municipal electric-light plant here. An election will soon be called to submit the proposition to the voters. E. H. P. Squire is a member of the board.

ALLIANCE, OHIO.—The City Council has passed an ordinance providing for the construction of a municipal electric-light plant, for which bonds to the amount of $15,000 were voted at the November election.

BOWLING GREEN, OHIO.—Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Feb. 17 for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the United States Post Office at Bowling Green. Drawings and specifications may be obtained at this office or from the custodian of site at Bowling Green, O. Wenderoth is supervising architect.

COLUMBUS, OHIO.—The City Council has granted the Columbus Ry. & Lt. Co. a franchise to extend its Leonard Avenue line in Columbus to Shepard.

PORT CLINTON, OHIO.—The City Council has refused the proposition made by the Northwestern Ohio Ry. & Lt. Co. to furnish electricity for lamps and motors for municipal purposes. The company offered to install a new street-lighting system and furnish the service at a reduced rate in return for an extension of its franchise. The Council has been securing data and will consider the advisability of establishing a municipal electric plant before granting any franchise.

TOLEDO, OHIO.—The Central Union Tel. Co. has sold its exchanges in Jerry City, Bloomdale and Cygnet, Wood County, to the Oil Belt Tel. Co., now operating at Cygnet and Portage.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & El. Co. has increased its capital stock by $100,000.

SOPER, OKLA.—A company has been organized to supply electricity for lamps and motors. J. W. Whitehead and J. F. McMillan, of Soper, and L. Stokes, of Forney, are interested in the project.

STONEWALL, OKLA.—At an election held recently the proposition to establish a municipal electric light plant was carried.

EUGENE, ORE.—The City Council is considering an ordinance which will require all electric light and power wires and telephone wires to be placed underground in the business district.

HOOD RIVER, ORE.—Work will soon begin on the construction of a 7000-hp hydroelectric plant by the Pacific Pwr. & Lt. Co. at Hood River to supply energy to operate an electric railway through Hood River Valley. The cost of the proposed plant and distributing system is estimated at $750,000. In addition to supplying power to the proposed electric railway, the company will furnish electricity to industrial concerns in Hood River and at other points as far east as The Dalles. Transmission lines will be extended to the irrigation project at Grand Dalles, Wash. Service will also be supplied to other irrigation work within reasonable distance. The new enterprise will be operated independently of the Hood River Gas & El. Co. While the Pacific Pwr. & Lt. Co. does not propose to promote a railroad project through the Hood River Valley, it will lend its aid to any legitimate enterprise that proposes to build such a line. Guy W. Talbot is president of the company.

PORTLAND, ORE.—The Northwestern El. Co. has applied to the court of Multnomah County for a blanket franchise entitling it to erect electric transmission lines along the county roads from the Columbia River to the city limits of Portland.

PORTLAND, ORE.—The Electric Engineering Corpn., 46 First Street, Portland, has secured contract for installing a 1000-kw hydro-electric development on Wind River, Washington, to supply electricity for logging purposes. The company, it is said, would like to receive prices on material and equipment needed for the project.

ASHLAND, PA.—The Edison El. Illg. Co., of Ashland, expects to erect within the next eight months 5 miles of new transmission lines into the surrounding territory and to purchase one 300-hp boiler and copper wire and other supplies for line extensions. The company has just installed a 50-lamp General Electric magnetite arc-lamp system. R. D. Heaton is president and general manager and M. E. Russell, secretary.

LEBANON, PA.—Eight Lebanon County electric companies have been consolidated under the name of the Lebanon Valley El. Lt. Co., of Lebanon, with a capital stock of $80,000. The companies merged are the West Lebanon El. Lt. Co., capitalized at $5,000; Swatara El. Lt. Co., $25,000; Hebron El. Lt. Co., $5,000; Palmyra El. Lt. Co., $20,000; Lebanon El. Lt. Co., $10,000; Myerstown El. Lt. Co., $5,000; Mill Creek Township El. Lt. Co., $5,000, and Jackson Township El. Lt. Co., $5,000. It is said that a large power development is planned. The officers of the company are: Joseph B. Weaver, president; Henry Weaver, vice-president; Daniel Weaver, treasurer, and Raymond S. Bicksler, secretary, all of Lebanon.

MIDLAND, PA.—The Tri-State Ry. & El. Co., of East Liverpool, Ohio, will soon begin work on the construction of a power plant near Midland, Pa., to cost about $2,000,000. The company has obtained control of several mines near the proposed site, to insure fuel. The J. G. White Engineering Co., 43 Exchange Place, New York, N. Y., will have charge of the work. W. R. W. Griffin is general manager.

POTTSVILLE, PA.—The Eastern Pennsylvania Ry. Co. is planning to build a new substation at Frackville. Work has been started on the erection of a high-tension line from Pottsville to Frackville to feed the substation.

NEWPORT, R. I.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 8 for furnishing and installing a direct-current switchboard and station wiring at the naval torpedo station, Newport, R. I., estimated cost $11,500. Plans and specifications may be obtained on application to the bureau or to the commandant of the naval station, Narragansett Bay, Newport, R. I. H. R. Stanford is chief of bureau.

PROVIDENCE, R. I.—City Sergeant T. Frederick Chase, custodian of the City Hall, has recommended to the City Council an appropriation to improve the lighting facilities in the building.

SIOUX FALLS, S. D.—Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Feb. 3 for the installation of an electric passenger elevator and hydraulic lift in the United States Post Office and Court House at Sioux Falls, S. D., in accordance with drawings and specifications, copies of which may be obtained at this office. O. Wenderoth is Supervising Architect.

YANKTON, S. D.—Sealed proposals will be received at the office of John W. Summers, City Auditor, until January 29 for furnishing material, equipment and constructing water-works system for the city of Yankton, as follows: Division 1—Brick pumping station, equipped with two electrically driven centrifugal turbine or volute pumps of 300 gal. per minute capacity; one centrifugal, turbine or volute booster pump of 1000 gal. per minute capacity, belt-connected to a 60-hp distillate or fuel oil engine; remote control and automatic starter for service pumps and all necessary piping, valves and equipment. Division 2—One ingot iron tank, 400,000 gal. capacity, erected on steel tower 30 ft. high; foundations, two valves and valve chamber complete. Division 3—Trenching, laying and finishing complete the distribution system, consisting of laying 6-in., 8-in., 10-in. and 12-in. wood or cast-iron pipe, valves, 567 service connections, 44 fire hydrants, 28,310 lb. of special castings for wood pipe, or 34,424 lb. of special castings for cast-iron pipe. Plans and specifications may be seen and blank forms of proposals, which must be used, may be secured at the office of the city auditor. Plans and specifications may be secured from the engineers upon payment of $15, which will be refunded upon return of same. Proposals for each division must be made on separate blanks.

ELIZABETHTOWN, TENN.—The Watauga Pwr. Co., contemplates extensive additions and improvements to its system, for which bonds to the amount of $300,000 will be issued.

JACKSON, TENN.—The Jackson Ry. & Lt. Co. contemplates extending its railway up Porter Street to Winter's Grove.

KNOXVILLE, TENN.—The Knoxville Ry. & Lt. Co. has been granted a franchise by the Knox County Court to construct and operate lines over the Kingston turnpike. The company proposes to extend its lines to the Eastern Hospital for the Insane, 5 miles west of the city.

SEVIERVILLE, TENN.—Preparations are being made for the installation of an electric-light plant in Sevierville. Material for the plant has already been purchased. D. R. Shearer, consulting engineer, of Knoxville, has charge of the engineering work. Clyde McMahn is president of the company.

DALLAS, TEX.—The Hobson El. Co. has amended its charter increasing its capital stock from $196,000 to $350,000 and changing its name to the Southwest General El. Co.

DALLAS, TEX.—The Stone & Webster Engineering Corpn., of Boston, Mass., expects to begin work on construction of its proposed electric railway, which is to run between Dallas and Terrell, a distance of about 30 miles, about March 1.

EAGLE PASS, TEX.—The Texas Lt. & Pwr. Co., which controls the International El. Co. and the Eagle Pass Wtr. Co., is making arrangements to furnish the Indio Ranch (consisting of about 3000 acres) with energy to operate pumps for irrigation purposes. The transmission line, it is stated, will eventually be extended to Carrizo Springs and Cometa County, and eventually up the Rio Grande as far as Los Moras.

GRANBURY, TEX.—The proposition to issue bonds for the installation of an electric-light plant will soon be submitted to the voters.

ITALY, TEX.—The Texas Pwr. & Lt. Co., of Dallas, has purchased the electric plant of the Italy Wtr. Co. and has been granted a 50-year franchise to operate an electric-light system here.

SEADRIFT, TEX.—The construction of an electric-light plant, water-works system and ice plant in Seadrift is under consideration. V. V. Elick and E. Salyer, of Granger, are interested in the project.

WACO, TEX.—The Southern Trac. Co. is preparing to make important improvements to the local street railway system. It is proposed to extend the railway and double-track portions of the system. The company is also preparing to begin at an early date the erection of a large central power station.

WAXAHACHIE, TEX.—The installation of a municipal electric-light plant in Waxahachie is under consideration.

OGDEN, UTAH.—Preparations are being made by the Utah Lt. & Ry. Co. for the erection of a transmission line to connect the southern Idaho plants with the Salt Lake City system. The proposed route will follow the shores of the lake.

SALT LAKE CITY, UTAH.—The County Commissioners have granted the petition of the Utah Lt. & Ry. Co. asking for an amendment to the charter purchased from the Telluride Pwr. Co. authorizing the extension of its transmission line along the Butterfield Canyon road from Lark to Harriman.

SALT LAKE CITY, UTAH.—The Utah Pwr. & Lt. Co. has purchased the electric plant of the Utah-Idaho Sugar Co. on Bear River, near Collinston. The Utah Pwr. & Lt. Co. proposes to increase the supply of the water in the river next summer by impounding water in Bear Lake; it also proposes to develop water-power along the Bear River to generate electricity. Contract has been made for 22,000 kw additional at the Grace plant. A new plant will be built at Oneida with an output of 24,000 kw. D. C. Jackling is president of the power company and P. B. Sawyer vice-president and general manager.

ALEXANDRIA, VA.—The Washington-Virginia Ry. Co., of Washington, D. C., contemplates the construction of a new substation in Alexandria.

NATIONAL SOLDIERS' HOME, VA.—Proposals will be received at the office of treasurer, Southern branch of National Home for Disabled Soldiers, National Soldiers' Home, Va., until Feb. 5 for furnishing material and labor for repairs to electric transmission lines, installing electrically driven sewerage pump in building No. 18 and repairs to flooring to general mess hall and also hospital dining room. F. E. Skinner is treasurer.

CENTRALIA, WASH.—The City Commissioners are considering the proposition of supplying electricity for lamps and motors to Fords Prairie, west of Centralia, the service to be supplied from the municipal electric light plant.

SEATTLE, WASH.—The Puget Sound Trac., Lt. & Pwr. Co. has been granted permission to rebuild the cable railway on Madison Street. The railway will be equipped for electrical operation. The Stone & Webster Management Association, of Boston, Mass., is general manager.

VANCOUVER, WASH.—The Northwestern El. Co., of Portland, Ore., has applied to the City Council for a franchise to operate a street railway and light and power system in this city.

WAPATO, WASH.—Plans are being prepared by the Pacific Pwr. & Lt. Co. for increasing its present hydroelectric generating system at Naches, Wash., by 5000 hp. Work will begin at once under the direction of D. F. McGee, chief engineer, of Portland, Ore.

WINLOCK, WASH.—The City Council has granted the Independent El. Co. a franchise to erect and operate transmission lines for the distribution of electricity for lamps, heaters and motors in Winlock for a period of 50 years.

WHEELING, W. VA.—The Wheeling El. Co. has applied to the Board of Commissioners of the county of Ohio for a franchise to erect, maintain and operate transmission lines on the river road from the northern corporation line of the city of Wheeling to the southern line of Brooke County for the distribution of electricity for lamps, heaters and motors. John B. Garden is manager.

NEW WESTMINSTER, B. C., CAN.—The British Columbia El. Ry. Co. is preparing plans for a large electric transmission project, which includes the erection of a distribution station on the corner of Edmonds Avenue, Burnaby, B. C.

DAUPHIN, MAN., CAN.—The Town Council has decided to install a new plant with three times the output of the present plant. The erection of cluster lamps on the main thoroughfares is under consideration.

EUREKA, N. S., CAN.—The Nova Scotia Knitting Co. is installing an electric-lighting system in its mills. The company will also furnish electricity for lighting the town.

STEMACKE, N. S., CAN.—G. R. Marshall, of Stemacke, has recently installed a lighting system in Stemacke. The electric generating equipment is operated in connection with his mill. Mr. Marshall has also purchased the electric plant of Logan & Co. in Shubenacadie and is lighting that town. Electricity is supplied by the local plant, transmitted over a 4-mile single-phase transmission line.

TRENTON, N. S., CAN.—The Town Council has awarded a contract to the Pictou County El. Co., of Stellarton, for lighting the streets of the town. The contract calls for the installation of 100 60-watt tungsten lamps.

AURORA, ONT., CAN.—The Council has passed a by-law authorizing the purchase of the equipment of the Aurora El. Lt. Co.

BOBCAYGEON, ONT., CAN.—The municipal electric-light plant was recently destroyed by fire, causing a loss of about $5,000.

DRYDEN, ONT., CAN.—A by-law has been introduced to the Council advocating taking over the electric-lighting system of the Dryden Timber & Pwr. Co., to be owned and operated by the municipality.

NIAGARA FALLS, ONT., CAN.—The Niagara Falls Queen Victoria Park Commission has given the Ontario Pwr. Co. permission to enlarge its power house and install two additional units of 13,500 hp each, including turbines, generators, governors, switchboard, penstock, etc.

OWEN SOUND, ONT., CAN.—A by-law will be submitted to the ratepayers to authorize the issue of the $50,000 debentures to meet an overdraft and to cover needed extensions at the municipal electric-light plant. It is suggested that automatic stokers be installed and a low-pressure steam turbine to operate by exhaust steam.

ST. CATHARINES, ONT., CAN.—The City Council has reconsidered its refusal to negotiate with the Hydro-Electric Power Commission and will ask the commission to submit an estimate on the cost of furnishing 2000 hp.

STRATFORD, ONT., CAN.—A new transmission line from Stratford to Sebringville is under consideration, for which plans and estimates will soon be prepared.

MONTREAL, QUE., CAN.—Plans have been submitted to the Board of Control by Superintendent Parent of the City Light Department for the location of ornamental lamp standards on St. Catherine Street from Papineau to Atwater Avenue. The plans provide for 142 standards.

ROSTHERN, SASK., CAN.—A by-law authorizing an appropriation of funds for the installation of an electric-light plant will be submitted to the ratepayers.

YELLOW GRASS, SASK., CAN.—The town of Yellow Grass is contemplating the installation of an electric-light and power plant.

TAMPICO, TAMAULIPAS, MEX.—The Tampico El. Lt., Pwr. & Trac. Co. has begun work on construction of the new electric railway to La Barra, a distance of 6 miles. A new power house is being erected, which will be equipped with machinery to develop 3000 hp. All transmission lines will be placed underground where streets are asphalted and overhead elsewhere. The company will also install a new street-lighting system consisting of 270 magnetite-arc lamps. On the plazas 64 ornamental electroliers, each carrying five-lamp clusters, will be erected. It is expected to have the lighting system completed by Aug. 1, 1913.

New Industrial Companies

THE ATTIX ELECTRICAL ENGINEERING COMPANY, of Brooklyn, N. Y., has been incorporated by Frederick Van Note, T. Attix and C. Buchard Smith, 391 Fulton Street, Brooklyn, N. Y. The company is capitalized at $20,000 and proposes to do a general contracting business.

THE AUTOMATIC MUSIC COMPANY, of Brooklyn, N. Y., has been incorporated by Lina Strauss, Faust de Scio and Abram Ellenbogen, 63 Wall Street, New York, N. Y. The company is capitalized at $25,000 and proposes to manufacture and deal in automatic electric player pianos and organs.

THE G. A. BAUER COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to do a general electrical manufacturing and machinery business. The incorporators are Peter Hansen, Gustavus A. Bauer and Herry C. Kinne.

THE CENTRAL WELDING & MANUFACTURING COMPANY, of St. Louis, Mo., has been incorporated with a capital stock of $30,000 by Adolph P. Erker, Hugo Wedemeyer, Robert Bausch and Eugene B. Dyer. The company proposes to manufacture gas-welding apparatus and deal in electrical supplies, gas accessories, etc.

THE ELECTRIC GENERATOR & ACCUMULATOR COMPANY, of Chicago, Ill., has been incorporated by Philip L. Knoedler, Frederick W. McKenna, Charles B. Askew, Monroe Mitchell and James M. Snitzler. The company is capitalized at $15,000 and proposes to manufacture and deal in electrical apparatus.

THE ELECTRICAL DEVELOPMENT COMPANY, of New Orleans, La., has been incorporated with a capital stock of $10,000 to deal in electrical goods and appliances, patents, etc. The officers are Lyman C. Reed, president, and Charles B. Murphy, secretary.

New Incorporations

FAYETTEVILLE, ARK.—The Fayetteville Gas & El. Co. has been incorporated with a capital stock of $200,000. The officers are: George D. Locke, president; F. F. Freeman, vice-president; W. B. Felker, secretary, and J. S. Felker, treasurer.

SAN DIEGO, CAL.—The Escondido Lt. & Pwr. Co. has been incorporated with a capital stock of $50,000. The directors are: G. V. Thomas, E. G. Logan, W. W. Prior, Meredith Conway and C. S. Palmeter.

WILMINGTON, DEL.—The Municipal Public Service Corporation has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $2,500,000. The incorporators are: H. R. Ewart, C. J. Jacobs and H. W. Davis.

BEASON, ILL.—The Beason Tel. Co. has been incorporated with a capital stock of $7,000 by J. S. Haller, E. D. Blinn, Jr., and R. O. Haller.

PORTLAND, MAINE.—The Middle West Gas & El. Co. has been incorporated with a capital stock of $5,000,000 for the purpose of generating, distributing and selling light, heat and power, etc. A. F. Jones is president and T. L. Croteau, treasurer, both of Portland.

ST. LOUIS, MO.—The Iron County El. Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by W. T. McCaskey, S. F. Seager, James P. Pattens, John C. Murphy and Colin M. Selph.

NORTH WESTERN, N. Y.—The Westernville Rural Tel. Co. has been incorporated with a capital stock of $10,000 by D. E. Dillenbeck, Sarah Dillenbeck and Alice E. Dillenbeck, all of North Western.

Trade Publications

COPPER-CLAD WIRE.—The Duplex Metals Company, Chester, Pa., has added another to its series of leaflets telling about copper-clad wire, of which it is exclusive manufacturer.

ELECTRICAL HOUSE GOODS.—Partrick, Carter & Wilkins, Philadelphia, Pa., is sending out Catalog No. 26, which refers to annunciators and electrical house goods. Each device is briefly described and illustrated.

MOTORS.—"Westinghouse Motors, Their Serviceability to All Who Use Machinery," is the subject of a sixteen-page illustrated booklet issued by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

CHAIN-BELT MIXER.—A large, striking photograph of the chain-belt mixer manufactured by the Chain Belt Company, Milwaukee, Wis., is conspicuously shown in the calendar for 1913 which this company is sending out.

TURBINES.—A four-page advance leaflet on the Connecticut turbine has been issued by the Connecticut Turbine Manufacturing Company, New London, Conn. These turbines are manufactured in sizes from 25 hp to 500 hp for any speed.

AUTOMOBILE LIGHTING BATTERIES.—Recent leaflets being sent out by the Cleveland Electric Storage Battery Company, 116 Market Street, St. Louis, Mo., include one on its sparking and automobile lighting batteries and another containing a general talk on lighting and ignition specialties.

Business Notes

THE NEW PROCESS GEAR CORPORATION is the new name of the New Process Rawhide Company, of Syracuse, N. Y.

THE KOERTING & MATHIESEN COMPANY has moved its Chicago office from 630 West Adams Street to 160 North Fifth Avenue.

THE CUTLER-HAMMER MANUFACTURING COMPANY has moved its Boston office from 176 Federal Street to the new Columbian Life Building.

THE WHEELER CONDENSER & ENGINEERING COMPANY, Carteret, N. J., has acquired the American license to build turbo air pumps of the rotary water-jet type manufactured in Europe by the Allgemeine Elektricitäts Gesellschaft.

THE INTERNATIONAL ENGINEERING WORKS, LTD., have purchased the properties and reorganized the business of the Robb Engineering Company. The boiler works at South Framingham, Mass., will continue to build horizontal-return-tube, vertical and Robb-Brady boilers.

HESS-BRIGHT MANUFACTURING COMPANY.—The interests of Mr. Henry Hess in the Hess-Bright Manufacturing Company, of Philadelphia, have been acquired by the Deutsche Waffen und Munitions Fabriken, of Berlin, Germany, the makers of the D. W. F. ball bearings.

MR. MORRIS F. FOX, of the bond department of H. M. Byllesby & Company, Chicago, is opening an office in the Wells Building, Milwaukee, for the sale of Byllesby securities in the State of Wisconsin. Mr. Fox, who graduated from the School of Commerce of the University of Wisconsin, class of 1904, has been connected with Byllesby & Company for about six years.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 31, 1912

1,048,496. BRACE FOR CROSS-ARMS OF TELEGRAPH AND TELEPHONE POLES; Isaac Cline, Huntington, Ind. App. filed Feb. 7, 1911. Three-part pin-connected cross-arm brace for L-section.

1,048,500. CONVERTER; George W. Conrad and Harry E. Conrad, Nanty Glo, Pa. App. filed April 20, 1912. Mechanical rectifier having oscillating moving part, with actuating coils and blow magnets.

1,048,505. GALVANIC BATTERY; Eben G. Dodge, South Orange, N. J. App. filed Feb. 19, 1912. The negative element, having a depolarizing oxide, is subdivided into tablets held by framework.

1,048,507. AUTOMATIC ELECTRIC AIR BRAKE; Edward H. Dewson, New York, N. Y., and Walter V. Turner, Edgewood, Pa. App. filed April 12, 1909. Breaking of train wires automatically applies pneumatic car brakes.

1,048,548. SYSTEM FOR CONTROLLING ELECTROMOTORS; Christian Krämer, Frankfort-on-the-Main, Germany. App. filed March 11, 1910. Automatically controlled field-circuit means for compensating for generator remanence.

1,048,557. CONVEYANCE AND SIGNALING APPLIANCE THEREFOR; Ray H. Manson, Elyria, Ohio. App. filed Sept. 18, 1911. Push-button with resistance contact, for mounting on automobile steering wheel.

1,048,561. SELECTIVE SIGNALING SYSTEM; Judson McFell, Chicago, Ill. App. filed June 18, 1909. Selectors arranged for successive operation controlled by line impulses.

1,048,574. BATTERY TERMINAL; Roger M. Newbold, Chicago, Ill. App. filed Feb. 14, 1912. Threaded-stud lug connection for storage batteries.

1,048,581. CARBON ELECTRODE FOR ELECTRIC FURNACES; Berthold Redlich, Ratibor, Germany. App. filed Feb. 19, 1912. Electrode has conical metallic core to increase conductivity.

1,048,587. WIRE HOLDER FOR INSULATORS; Anthony J. Riefer and David P. Mays, Pittsburgh, Pa. App. filed March 29, 1912. The clamp band carries a grip socket with hasp lock.

1,048,588. POLE CHANGER; Charles H. Roth, Chicago, Ill. App. filed May 5, 1911. Oscillating arm makes contacts with a bank of lugs.

1,048,603. HYDROELECTRIC SMELTING FURNACE; Antonio Tommasini, New York, N. Y. App. filed Aug. 1, 1912. Hydrogen supplied to hearth is heated electrically to melt ore charge.

1,048,636. TROLLEY-LINE CLAMP; Cletus N. Allerding, Mansfield, Ohio. App. filed Dec. 7, 1910. The clamping members, arranged with lugs and apertures, from journal sockets.

1,048,639. TELEGRAPH SYSTEM; William E. Athearn, Brooklyn, N. Y. App. filed Feb. 19, 1912. For main-office and sub-office use; the transmission instruments are operable independently of the signals.

1,048,642. APPARATUS FOR WELDING BY ELECTRICITY; William D. Bartlett, Cleveland, Ohio. App. filed April 24, 1911. Means for clamping the welding jaw firmly in position.

1,048,645. RHEOSTAT; Willie M. Bowles and Charley O. Allen, Shawnee, Okla. App. filed May 10, 1911. Screw adjusts compression of carbon blocks.

1,048,646. INSULATOR FOR RAIL JOINTS; Bancroft G. Braine, New York, N. Y. App. filed July 20, 1912. Insulating end post with rail section.

1,048,656. TROLLEY-WIRE HANGER; John Christensen, Evans City, Pa. App. filed Sept. 18, 1911. Split washer grips wire-clamping ears.

1,048,661. TROLLEY POLE; Robert M. Craig, Paterson, N. J. App. filed May 28, 1912. Wheel is mounted on ball bearings.

1,048,670. CONTACT FOR ELECTROMAGNETIC MECHANISM; Reginald A. Fessenden, Washington, D. C. App. filed March 16, 1906. Spherical platinum-iridium contacts on pivoted and resilient arms.

1,048,706. BRACKET FOR CURRENT-CONDUCTING WIRES; Arie Kleinhesselink, Orange City, Ia. App. filed Aug. 12, 1912. Bracket pin with notch for second wire.

1,048,732. TROLLEY; Jozef Piotrowski, Uniontown, Pa. App. filed March 8, 1912. Ball-pivot mounting of trolley wheel.

1,048,736. INSULATING CLEAT; Benjamin Richards, Canton, Mass. App. filed March 28, 1910. Angle cleat with insulating head screw.

1,048,742. TROLLEY; Teodore Scherba, Pittsburgh, Pa. App. filed April 17, 1912. Harp stem swiveled in pole-end socket.

1,048,762. METHOD OF COOLING VAPOR ELECTRIC APPARATUS; Percy H. Thomas, East Orange, N. J. App. filed March 28, 1904. Spectrum of light-giving vapor is supplemented by that of permanent gas.

1,048,773. ELECTRIC BATTERY; Frederick L. White, Lakewood, Ohio. App. filed March 29, 1912. Kerosene-oil lining between positive electrode and mix.

1,048,798. ELECTRICALLY OPERATED ATTACHMENT FOR PIANOS; John L. Black, Hamilton, Ohio. App. filed Feb. 23, 1911. Electromagnetic hammers for drums, bells, etc.

1,048,809. WIRE-BENDING PLIERS; Robert F. Coleman, Philadelphia, Pa. App. filed Aug. 21, 1912. Anvils carried on jaws co-act with central bar anvil.

1,048,817. GYROSTATIC MECHANISM; Emil Falcke, Dresden, Germany. App. filed Oct. 26, 1910. If energy supply is interrupted, gyrostat motor becomes generator to energize controlling apparatus.

1,048,819. ALTERNATING-CURRENT RECTIFIER; Charles F. Fayer, New York, N. Y. App. filed March 22, 1912. Commutating contacts are cup-shaped for spark diversion.

1,048,824. MAGNETIC SEPARATOR; De Nise A. Griffiths, Chicago, Ill. App. filed May 3, 1909. Scraper arms are yieldably mounted on magnetic drum.

1,048,832. INTERRUPTER FOR IGNITION MACHINES; Otto Heins, Edgewater, N. J. App. filed May 26, 1911. Cam-ring controls period of ignition.

1,048,847. FUSE SWITCHES; Arthur V. A. McHarg, New York, N. Y. App. filed June 27, 1912. Fuse is de-energized when in position for removal or insertion.

1,048,849. WIRELESS BREAK KEY; Grier P. Mobley, San Antonio, Tex. App. filed July 10, 1911; app. renewed Nov. 19, 1912. Back contact for connection to receiving apparatus.

1,048,850. INSULATOR; John W. Moore, Carey, Ohio. App. filed April 6, 1912. Two-part knob, with V-notches and aligning fingers.

1,048,856. PROTECTIVE CASING FOR ELECTRIC METERS; Thomas E. Murray, New York, N. Y. App. filed Jan. 25, 1912. Case telescopes to give access to connections.

1,048,857. ELECTRIC CUT-OUT; Thomas E. Murray, New York, N. Y. App. filed May 31, 1912. Cup-shaped contacts and insulating plug.

1,048,858. ELECTRIC BATH CABINET; Thomas E. Murray, New York, N. Y. App. filed Sept. 16, 1912. Folding cabinet with lamps in non-collapsible tubes.

1,048,859. ELECTRIC FUSE; Thomas E. Murray, Jr., New York, N. Y. App. filed April 22, 1912. Refractory insulating material protects ends.

1,048,880. TRAIN-CONTROLLING DEVICE; August W. Reiling, Fort Wayne, Ind. App. filed Feb. 6, 1911. Electromagnet disconnects shunt winding.

1,048,903. CURRENT DISTRIBUTER AND TIMER; James M. Smith, Philadelphia, Pa. App. filed Jan. 13, 1909. Cylindrical contacts and depressions.

1,048,913. ELECTRIC BELL; Harve Reed Stuart, Springfield, Ohio, and Frederic Schaefer, Pittsburgh, Pa. App. filed Feb. 20, 1912. Alternating-current bell with polarized cores and circuit closer.

1,048,928. STRETCHER FOR CABLES, WIRES, ETC.; Frederick John Aster, Rock Island, Ill., and Adolphus William Malone, Davenport, Ia. App. filed Aug. 24, 1912. Toggle-wedge grip for wire.

1,048,930. ELECTRIC PYROMETER; Henry Earl Beighlee, East Cleveland, Ohio. App. filed June 15, 1908. Thermo-sensitive resistance in Wheatstone bridge combination.

1,048,978. SIGNAL DEVICE; Maurice Levison, Chicago, Ill. App. filed Aug. 28, 1907. Call may be established and released independently.

1,048,980. SYSTEM OF MULTIPLE AND SIMULTANEOUS TELEGRAPHY; Ferdinando Lori, Padua, Italy. App. filed Jan. 13, 1906. Mechanically and electrically tuned arrangement of vibrating wires, condensers and transformer secondaries.

1,048,985. SYSTEM OF ELECTRICAL DISTRIBUTION; Louis C. Marburg, Milwaukee, Wis. App. filed Jan. 7, 1910. Control of flywheel generator set.

1,048,987. ELECTRICALLY OPERATED ALARM CLOCK; Robert Mauthe, Denver, Col. App. filed Dec. 18, 1911. Contacts completed by clock mechanism.

1,048,992. INSULATOR; George A. Mead, Mansfield, Ohio. App. filed July 29, 1908. Body forms encircling open groove.

1,048,999. CONTROLLING MECHANISM FOR MOTORS; Charles R. Pratt, Montclair, N. J. App. filed Aug. 7, 1908. Brake mechanism operable by relative speeds.

1,049,000. SPEED CONTROL; Charles R. Pratt, Montclair, N. J. App. filed Sept. 7, 1910. Automatic controller for main motor.

1,049,004. SECONDARY CLOCK; Alfred L. Sohm, Los Angeles, Cal. App. filed Oct. 29, 1910. For winding and setting telegraph clocks.

1,049,005. INSULATING COMPOSITION AND PROCESS OF MAKING THE SAME; Charles P. Steinmetz, Schenectady, N. Y. App. filed July 29, 1911. Mixture of talc with magnesium silicate.

1,049,011. ELECTRICAL APPARATUS; Carl J. E. Waxbom, Columbus, Ohio. App. filed Jan. 26, 1911. Gas-proof motor casing with non-magnetic filling.

1,049,028. CONTROLLING DEVICE FOR ELECTRIC MOTORS; Paul H. Zimmer, Schenectady, N. Y. App. filed April 10, 1908. Two-way speed controller.

1,049,040. OHMMETER; Thomas William Bibb, Seattle, Wash. App. filed July 27, 1911. Adjustable galvanometer calibrated to read resistance in circuit.

1,049,043. ELECTRICAL MELTING AND SOLDERING APPARATUS; Willie M. Bowles and Charley O. Allen, Shawnee, Okla. App. filed May 6, 1911. Carbon stick and cup form arc electrodes.

1,049,044. TELEGRAPHY; Clarence M. Breedlove, Birmingham, Ala. App. filed Sept. 20, 1911. Local station circuit.

1,049,066. TELEGRAPH INSTRUMENT; William H. Engle, Port Costa, Cal. App. filed Feb. 21, 1912. Key with vibratory pendulum contactor.

1,049,070. ELECTRIC LAMP; Frank L. Fowler, Philadelphia, Pa. App. filed March 28, 1912. Grooved base to secure lamp in socket.

1,049,114. DYNAMO-ELECTRIC MACHINE; James Colquhoun Macfarlane and Henry Burge, Arc Works, Chelmsford, England. App. filed Feb. 7, 1910. Single-ring armature with three terminals, outer two in series with fields.

1,049,115. ELECTRICALLY OPERATED MOTOR VEHICLE; James C. Macfarlane and Henry Burge, Arc Works, Chelmsford, England. App. filed June 6, 1912. Wheel motors driven by motor-generator set.

1,049,132. WIRE-TERMINAL PLUG; Claude E. Mowrer, Ypsilanti, Mich. App. filed April 10, 1912. Pivoted jaw clamp, with lock.

1,049,189. TROLLEY-LINE CLAMP; Cletus N. Allerding, Mansfield, Ohio. App. filed Dec. 7, 1910. Clamp ear with swiveled head.

1,049,247. ELECTRICALLY OPERATED MOTOR VEHICLE; James C. Macfarlane and Henry Burge, Arc Works, Chelmsford, England. App. filed June 6, 1912. Pedal-operated controller affecting motor torque and braking.

1,049,253. SOUND-TRANSMITTING APPARATUS; Charles W. McGonigle, Algona, Wash. App. filed Feb. 5, 1912. Gang connection of transmitters to double diaphragm.

1,049,296. ELECTRIC SWITCH; Clifford E. Hain, Omaha, Neb. App. filed Feb. 29, 1912. Two electromagnets with common pole-piece and armature.

1,049,305. COMBINATION SWITCH AND SAFETY FUSE; James S. Johnston, Utica, N. Y. App. filed March 12, 1908. Axially telescoping switch parts.

1,049,308. FIRE-ALARM-BOX MECHANISM; Christian F. Klein and Edward A. Pyles, Baltimore, Md. App. filed March 27, 1911. Combination of department and local alarms.